

AHRQ HEALTH INFORMATION TECHNOLOGY PORTFOLIO

2011 ANNUAL REPORT AND PROJECT SUMMARIES



Agency for Healthcare Research and Quality
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HEALTH IT

AHRQ Health Information Technology Portfolio 2011 Annual Report and Project Summaries

Prepared for:

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HEALTH IT

Director's Message

The mission of the Agency for Healthcare Research and Quality (AHRQ) is to improve the quality of health care for all Americans. AHRQ's Health IT Portfolio supports our broad mission by demonstrating where health IT improves quality, safety, and effectiveness, enhancing the evidence base for health IT, and preparing the field for effective use of future innovations.

The Health IT Portfolio is one of six portfolios within the Agency designed to bring practical, evidence-based information to medical providers, health care consumers, and policymakers. The Agency's health IT work is highly complementary to related activities supported by our colleagues in the public and private sectors.

We are very pleased to offer our stakeholders this annual report, which highlights the Portfolio's extensive accomplishments. AHRQ is currently funding 169 projects in 36 States. The projects active in 2011 constitute a real-world laboratory for examining how health IT can:

- Make care safer.
- Ensure that people and families are engaged as partners in their care.
- Promote effective communication and coordination of care.
- Facilitate development and spread of new health care delivery models.

We hope that the reader will find this report helpful and informative and that we inspire further exploration and collaboration across the research and health care community.

We welcome comments on the 2011 Health IT Portfolio Annual Report. Comments may be sent by mail to Vera Rosenthal: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by email to Vera.Rosenthal@AHRQ.hhs.gov.



P. Jonathan White, M.D.

Director

Health Information Technology Portfolio

Acknowledgments

JSI would like to thank our task order officer, Vera Rosenthal, as well as Rebecca Roper, Corey Mackison, and other AHRQ staff for their contributions to this report.

AHRQ is most grateful to its contractors and grantees for their ongoing provision of timely, informative reports and their participation in this initiative.

Report Acronym List

ACTION–Accelerating Change and Transformation in Organizations and Networks
AHRQ–Agency for Healthcare Research and Quality
ARRA–American Recovery and Reinvestment Act
ARRS–AHRQ Research Reporting System
ASQ–Ambulatory Safety and Quality Program
CDS–clinical decision support
CERTs–Centers for Education and Research on Therapeutics
CMS–Centers for Medicare & Medicaid Services
CP3–Center for Primary Care, Prevention, and Clinical Partnerships
CPOE–computerized provider order entry
DHHS–Department of Health and Human Services
EHR–electronic health record
EQM–Enabling Quality Measurement through Health IT Program
FOA–funding opportunity announcement
HIE–health information exchange
HIO–health information organization
IAA–interagency agreement
IQHIT–Improving Quality through Clinician Use of Health IT Program
IRB–Institutional Review Board
MCP–Management of Individuals with Complex Healthcare Needs through Health IT Program
NIH–National Institutes of Health
NRC–National Resource Center for Health Information Technology
OCKT–Office of Communications and Knowledge Transfer
ONC–Office of the National Coordinator for Health Information Technology
PA–program announcement
PBRN–Practice-Based Research Network
PCC–patient-centered care
PEATOC–Program Evaluation and Analysis Task Order Contract
PHR–personal health record
PI–principal investigator
REC–regional extension center
RFA–request for application
RFP–requests for proposal
RFTO–request for task order
SEN–special emphasis notice
SRD–State and Regional Demonstration Project
TA–technical assistance
THQIT–Transforming Health Care Quality through Information Technology Program

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Executive Summary

The Health Information Technology Portfolio in 2011

Research funded by the Agency for Healthcare Research and Quality (AHRQ) Health Information Technology (IT) Portfolio contributes to efforts for improving health care nationwide by demonstrating health IT innovations in various health care settings. The Portfolio staff works collaboratively with staff from other AHRQ Centers and Portfolios, as well as other Federal and outside partners. The Portfolio's body of research represents some of the most important sources of evidence regarding the impact of technology on improving quality, safety, effectiveness, and efficiency of health care. The research conducted in 2011 has generated evidence and insight that can facilitate successful design, implementation, and use of health IT. The Portfolio team hopes that this work will serve as a catalyst for further research and collaborations across the research community.

The projects funded through the Health IT Portfolio are conducted in real care delivery settings and identify the practical issues of health IT research, such as:

- Obtaining buy-in from staff and clinicians.
- Informing the effective implementation of health IT, especially in underserved and under-resourced areas.
- Evaluating costs and benefits of health IT.
- Identifying barriers and facilitators to implementation.
- Understanding the impact of health IT.

Report Purpose and Organization

The AHRQ Health IT 2011 Annual Report is designed to disseminate information on the research areas and progress at both the Portfolio and project

To support its broad mission of improving the quality of health care for all Americans, AHRQ has focused its health IT initiatives on the following three strategic goals:

Improve Health Care Decisionmaking

Support Patient-Centered Care

Improve Medication Management

levels. The Portfolio and the grants and contracts it funds are summarized by a number of broad categories, including: Health IT Portfolio strategic goals, AHRQ business goals, funding mechanisms, geographic distribution, and lifetime funding as of 2011. The report also describes activities that took place throughout the year, and synthesizes outputs, challenges, and successes of the 169 projects active in calendar year 2011. Dissemination activities of the project teams and the AHRQ Health IT staff are also highlighted. In addition, individual project summaries for the grants and contracts provide an overview and status updates of each of the projects' long-term objectives and specific aims, updates on completed or ongoing project activities, and preliminary or final findings and impact. The summaries are an excellent resource for implementers of health IT, prospective research applicants, and others interested in the challenges and successes of health IT implementation and use in terms of research and practical application. They describe the characteristics of successful research projects and principal investigators' abilities to adjust and persevere through the real-world challenges and setbacks encountered in health IT research.

Report Availability

The report and individual project summaries are available as easy-to-access Web-based documents

through the AHRQ-funded project search tool on the National Resource Center (NRC) for Health IT Web site. The NRC provides a platform to support outreach and delivery of information from AHRQ, and to share expertise across the multidisciplinary fields that are engaged in critical aspects of health IT research. Users of the Web site can search for project summaries, project-related news, and project publications, as well as identify projects based on several categories, including type of technology, care setting, and target population.

2011 Annual Report Highlights

AHRQ's Health IT Portfolio comprised 169 projects in 2011 consisting of 129 grants and 40 contracts. Projects are diverse, representing the full range of technologies, care settings, and geography, including organizations in 36 States and the District of Columbia. The lifetime funding for these grants and contracts is approximately \$110 million and \$51 million, respectively.

Highlights of the activities accomplished in 2011:

- The Enabling Quality Measurement (EQM) Through Health IT grant initiative, one of four Ambulatory Safety and Quality (ASQ) RFAs, concluded. The ASQ initiative, established in 2007, supported grants to improve the safety and quality of ambulatory health care in the United States. The research funded under the EQM program added to the knowledge base on developing safety and quality measures in ambulatory care settings, automating quality measurement, demonstrating the ability of electronic data systems to expand potential safety and quality measures, and demonstrating improved ability to export data for reporting performance on measures and improvement.
- The remaining three of the six contracts supporting AHRQ's 5-year State and Regional Demonstrations in Health IT concluded. These projects, in Delaware,

Rhode Island, and Utah, supported data sharing and exchange activities aimed at improving health care on a State or regional level, and examined characteristics of health information organizations. The six States developed a variety of approaches to health information exchange (HIE), with different technical, business, and governance models.

- The Portfolio released the first in a series of videos highlighting successful projects from grantees and contractors which can serve as a good example for future projects. The first video highlighted the development of DVD segments by Kate Lapane, Ph.D., and her research team on various health topics to help olderadultsaddressmedicationchallenges. The video can be found at: www.healthit.ahrq.gov/AHRQHealthITSuccessStoriesLapaneVideo. Other videos, as well as written stories, are available at: www.healthit.ahrq.gov/SuccessStories.
- The National Research Council of the National Academies of Science conducted a [project](#) and formed a multidisciplinary consensus panel of recognized experts to examine a diverse range of behavioral and human factors issues resulting from recent trends and challenges associated with the increasing migration of medical devices, technologies, and care practices into the home. The project resulted in a consensus report identifying and discussing major human factors issues in home health care as well as a brief companion designer's guide for home health care information technology.

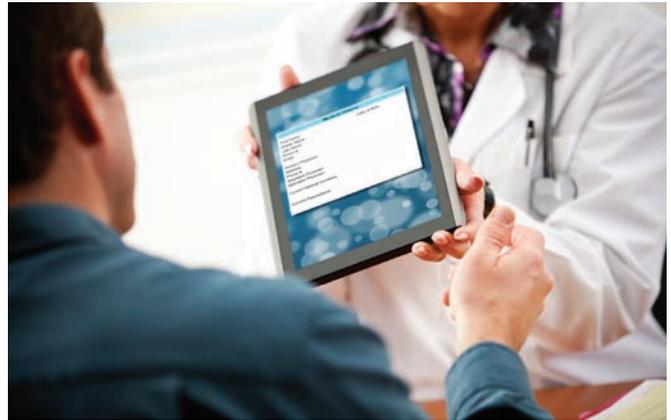
AHRQ's Health IT Portfolio supports the Agency's broad mission by demonstrating where health IT improves quality, safety, and effectiveness, enhancing the evidence base for health IT, and preparing the field for effective use of future innovations. We hope that the reader will find the report informative and inspire research and collaboration across the research and health care community.

I. Introduction

Welcome to the Agency for Healthcare Research and Quality (AHRQ) Health Information Technology Portfolio 2011 Annual Report. This report highlights the Portfolio's initiatives that support research projects that advance the field of health information technology (IT) in health care. By developing secure and private electronic health records for most Americans and making health information available electronically when and where it is needed, health IT can improve the quality of care, even as it makes health care more cost-effective. This report demonstrates how the projects supported through the Portfolio have helped develop an evidence base around the impact of health IT on the quality, safety, effectiveness, and efficiency of health care.

This report is available as a Web-based document on the National Resource Center for Health IT (NRC) Web site (www.healthit.ahrq.gov). In addition, the NRC Web site also provides individual project summaries, project-related news, and project publications. Projects can be identified by geography, principal investigator, type of technology, care setting, target population, and aspect of care.

In 2011, 169 health IT grants and contracts were active during the calendar year. The report overview includes the following categories: Portfolio strategic goals, AHRQ business goals, funding mechanisms,



geographic distribution, and lifetime funding as of 2011. In addition, the report highlights some project successes and challenges, as well as the dissemination activities of the projects and the AHRQ Health IT team. Individual project summaries for projects are also included and provide additional detail, such as an overview of the project and a description of activities that occurred in 2011.

As this report illustrates, AHRQ is committed to improving the quality of health care for all Americans. The Health IT Portfolio initiatives are aimed at helping clinicians provide higher quality, safer health care; stimulating the implementation of health IT, especially in rural and underserved areas; and identifying the most successful approaches and barriers to health IT implementation.

II. About the Health IT Portfolio

A. Description of the Health IT Portfolio

AHRQ is the lead agency charged with supporting research designed to improve the quality of health care, reduce health care costs, and broaden access to essential services. AHRQ's wide array of research brings practical, evidence-based information to medical practitioners, consumers, and policymakers. The Agency is comprised of nine Offices and Centers and supports a series of interrelated health services research programs that individually and collectively seek to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. AHRQ also has six Portfolios: Health IT, Comparative Effectiveness, Innovations and Emerging Issues, Patient Safety Research, Prevention and Care Management, and Value Research. A full description of the Offices, Centers, and Portfolios is included in Appendix A.

The primary focus of the Health IT Portfolio is to improve the quality of American health care by generating evidence through extramural research, synthesizing and disseminating best evidence, and providing evidence-based tools for health IT implementers and policymakers.

The Director of the Portfolio, P. Jonathan White, M.D., works with a core team of eight staff. Additional AHRQ staff members serve as program officials to support the Portfolio's activities. Portfolio staff members also collaborate with colleagues from other AHRQ Offices, particularly the Office of Communication and Knowledge Transfer (OCKT), to disseminate information from various health IT endeavors. The AHRQ Health IT Portfolio supported a variety of activities in 2011.

The Health IT Portfolio members participated in AHRQ's fifth annual conference on September 18-21, 2011, in Bethesda, Maryland. This conference was designed to showcase the best of the Agency's research and provide examples of how that research is being implemented at all levels in health care delivery. Titled "Leading Through Innovation & Collaboration," the conference featured presentations in seven major themes, each of which intersected with health IT topics in some capacity. Portfolio staff also held a tabletop exhibit to share information about how research and demonstrations inform health IT policy and practice and how health IT can improve the quality and cost-effectiveness of American health care.

Throughout the year, members of the Health IT Portfolio made numerous presentations to various stakeholder groups and venues, including the Annual Conference and Exhibition of the Healthcare Information and Management Systems Society (HIMSS), the American Medical Informatics Association (AMIA), the Institute of Medicine (IOM), the Health Resources and Services Administration (HRSA) Health IT and Quality Policy Council, the Centers for Medicare & Medicaid Services (CMS) Multi-State Medicaid Health Information Technology for Economic and Clinical Health Conference, and the EHR Usability Symposium.

Portfolio staff partnered with Federal and private organizations to co-sponsor conferences, provide funding for projects, and share information. Partners included HRSA, the Indian Health Service (IHS), CMS, Kaiser Permanente, the Commonwealth Fund, and the Robert Wood Johnson Foundation.

Through one of these partnerships, members of the Health IT team also served as program officials for American Recovery and Reinvestment Act (ARRA) contracts funded by the Office of the National Coordinator for Health IT (ONC), helping with projects designed to improve quality of health IT and advance CMS's concept of Meaningful Use. To achieve this endeavor, in collaboration with ONC, AHRQ is developing the national Health Information Technology Research Center (HITRC) using the NRC as a contracting mechanism. The purposes of the HITRC are to:

1. Provide a forum for the exchange of knowledge and experience; accelerate the transfer of lessons learned from existing public and private sector initiatives, including those currently receiving Federal financial support.
2. Assemble, analyze, and widely disseminate evidence and experience related to the adoption, implementation, and effective use of health IT that allows for the electronic exchange and use of health information.
3. Provide technical assistance for the establishment and evaluation of regional and local health information networks to facilitate the electronic exchange of information across health care settings and improve the quality of health care.
4. Provide technical assistance for the development and dissemination of solutions to barriers to the exchange of electronic health information
5. Learn about effective strategies to adopt and utilize health IT in medically underserved communities.

As of December 2011, there were 12 ongoing task orders awarded through the HITRC initiative.

B. National Resource Center for Health IT Web site

The National Resource Center (NRC) for Health IT Web site (www.healthit.ahrq.gov) is a central mechanism for disseminating findings generated from AHRQ-funded health IT projects. Additionally, it serves as a platform to support outreach and delivery of information from AHRQ and to share expertise across the multidisciplinary fields that are engaged in critical aspects of health IT implementation and research.

The NRC Web site is a collection of information, resources, and products largely generated by the Health IT Portfolio staff and sponsored grantees or contractors to make them available in one convenient location. The following categories represent just some of the information that is available on the NRC Web site:

Events: Past and upcoming health IT-related events sponsored by AHRQ are listed on the [Events](#) page of the Web site. The list of events includes activities such as the AHRQ Annual Conferences hosted annually in September and the National Web-Based Teleconferences that feature interactive presentations by experts in a particular field of health IT, and other important health IT activities. Links to resources, such as meeting agendas and presentations, are provided.

AHRQ-Funded Projects: Detailed information about each health IT-funded project is available on the [AHRQ-Funded Projects](#) page of the Web site. Users may search for projects by geography, health care setting, type of health IT technology, target population, aspect of care, and principal investigator. In addition, this section provides more in-depth content on various initiatives, for example:

- The [Success Stories](#) page is comprised of a series of project stories, highlighting projects that have demonstrated positive impact on health care outcomes or address gaps in the research literature.
- The [Transforming Healthcare Quality through Health IT \(THQIT\)](#) page highlights content from the 118 grants funded under the closed THQIT program to support health IT implementation. Case studies highlight a variety of the THQIT grants, and a report summarizes the peer-reviewed published findings of the Demonstrating the Value of Health Information Technology RFA (HS-04-012).
- The [Clinical Decision Support Initiative](#) page describes the two contracts that focus on the development, adoption, implementation, and evaluation of best practices using clinical decision support (CDS). These contracts are advancing the understanding of how best to incorporate CDS into health care delivery.

Health IT Tools and Resources: AHRQ and its community of contractors and grantees have developed tools to help health care organizations plan, implement, and evaluate health IT. These freely available tools provide users with the resources they need to learn more about many aspects of health IT, to conduct evaluations and surveys, to work through cost-

benefit evaluations, to assess workflow, and to see examples of documents commonly used in health IT. Tools include the following:

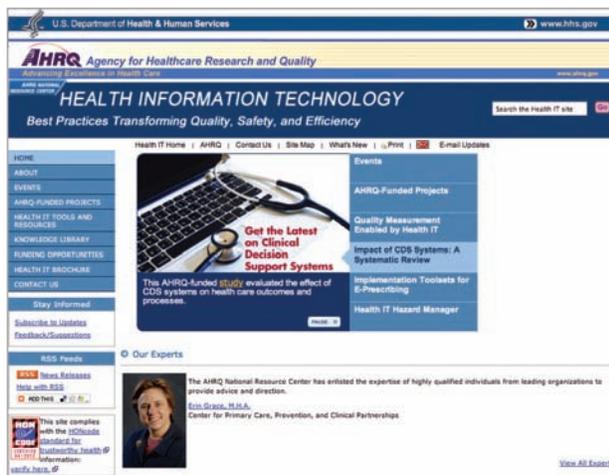
- The [Health IT Projects Publication Database](#), a collection of publications describing work from the AHRQ Health IT Portfolio-funded contracts and grants.
- The [Health IT Literacy Guide](#), which provides resources for the design and development of accessible health IT for populations with limited literacy and for purchasers to evaluate health IT products.
- The [Health IT Survey Compendium](#), a set of publicly available health IT surveys.
- The [Workflow Assessment for Health IT Toolkit](#), a toolkit designed for people and organizations interested or involved in the planning, design, implementation, and use of health IT in ambulatory care.



Funding Opportunities: AHRQ lists open funding opportunity announcements (FOAs) for health IT and provides links to other Federal grant programs through the National Institutes for Health, HRSA, the Department of Defense, the Centers for Disease Control and Prevention (CDC), and the National Institute of Standards and Technology, as well as links to funding Web pages for non-governmental not-for-profit organizations.

C. AHRQ Business and Health IT Strategic Goals

All Health IT Portfolio-funded grants and contracts are categorized by their health IT strategic goal and their AHRQ business goal. These strategic and business goal categories are listed below, along with examples of projects from the Health IT Portfolio that illustrate



various initiatives working toward achieving those goals.

Health IT Strategic Goals

The health IT strategic goals were created to highlight the Portfolio's funding priorities.

Improved Decisionmaking: Projects that develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Project Example: *Closing the Feedback Loop to Improve Diagnostic Quality.* This project, led by Dr. Eta Berner at the University of Alabama at Birmingham (Grant # R18 HS 017060), is working under the hypothesis that harm can be prevented or mitigated by providing rapid feedback to the physician on patient health status and medication adherence, thereby closing the diagnostic loop. The study team developed an interactive voice response system to provide proactive followup and ongoing rapid feedback to physicians in ambulatory clinics and in emergency departments. Providers' responses to the feedback, their satisfaction with the feedback process, the impact on diagnostic and therapeutic quality, response to use of the interactive voice response and emergency department feedback systems, and the use of the feedback by physicians were all assessed as outcome measures. For the clinic sites, additional assessments included patient satisfaction and impact on health care costs.

Patient-Centered Care (PCC) or Health Information Exchange (HIE): Projects that develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Project Example: *Supporting Continuity of Care for Poisonings with Electronic Information Exchange.* This project, led by Dr. Mollie Rebecca Cummins at the University of Utah (Grant # R21 HS 018773), is using multiple approaches to study and describe the data requirements for electronic information exchange between primary care clinics and emergency departments; determine consensus among national experts on significant clinical, operational, and legal considerations; and demonstrate how HIE can improve quality of care. Long-term implications include the study of outcomes, quality improvement innovations, and the potential for computerized decision support.

Medication Management: Projects that develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Project Example: *Building an Implementation Toolset for E-Prescribing.* This project, led by Dr. Douglas Bell with the RAND Corporation (Contract # 290-06-0017-4), developed and tested complimentary e-prescribing toolsets: one for health care providers and another for pharmacies. The toolset serves as "how-to" guides for implementing e-prescribing across various ambulatory care settings and pharmacies. The toolsets include guidance on the complete lifecycle of activities expected to contribute to successful implementation, including technology requirements, workflow analysis tools, and governance agreement templates.

AHRQ Business Goals

The AHRQ business goals were developed to explain the operational side of the agency

and provide relevant stakeholders with a clear understanding of how AHRQ works toward its vision and mission.

Knowledge Creation: Projects that: 1) collect data on and produce measures of the quality, safety, effectiveness, and efficiency of American health care and health care systems or 2) foster the development of knowledge about improving health care, health care systems, and capacity (e.g., training, placement).

Project Example: *The Impact of Health Information Technology on Demand for Inpatient Services.* This dissertation grant led by Eric Barrette at the University of Minnesota, Twin Cities (Grant # R36 HS 018272) employed a demand analysis to examine the role of health IT in meeting inpatient health care service demands. The analysis included looking at the effect of hospital adoption of health IT on the demand for inpatient care, the estimated impact of health IT by type of inpatient service, and the effect of health IT changes on patient hospital choices.

Synthesis and Dissemination: Projects that: 1) create tools and synthesis of evidence including knowledge, measure, and data or 2) disseminate information to multiple stakeholders to improve the system.

Project Example: *Quality Oral Health Care Through Health Information Technology.* This project, led by Cheryl Austein-Casnoff with NORC (Contract # 290-07-10039T-1), convened an expert panel that included individuals from the fields of Medicaid, the Children's Health Insurance Plan (CHIP), dentistry, and health IT. The panel provided input into opportunities to use health IT to increase access to oral health care for children enrolled in the Medicaid and CHIP programs. The final report helped to identify the impact of Meaningful Use incentive payments on



dentists serving Medicaid-eligible children and how these payments might expand access to quality oral health care for children enrolled in Medicaid and/or CHIP.

Implementation and Use: Projects that partner with stakeholders to implement proven strategies for health care improvement, including empowering Americans to be proactive patients.

Project Example: *Improving Meaningful Access of Internet Health Information for Older Adults.* This project, led by Dr. Sara Czaja at the University of Miami (Grant # R21 HS018831), is refining four existing cognitive aiding tools designed to help individuals filter, integrate, and interpret Internet information. The refinement process is intended to enhance the usability of the tools to support effective use of health IT applications by older adult consumers. Data will be collected on how individual characteristics such as age, cognitive abilities, and health literacy influence information-seeking performance and the perceived usability versus actual use of the tools. The tool refinement process and evaluation of findings will be used to develop a set of tools that are easy to use and that support effective use of e-health applications by older adult health care consumers.

D. Funding Mechanisms

There are a variety of funding mechanisms used by the Health IT Portfolio. Each award mechanism specifies the content, format, and timeline for deliverables, including periodic reporting requirements for completion of milestones and budget updates. *Grants, cooperative agreements, contracts, and interagency agreements* are four common mechanisms that AHRQ applies to carry out a wide variety of health services research and administrative activities. Descriptions of each are provided below:

Grants and Cooperative Agreements

Grants provide money, property, or other direct assistance to allow eligible entities to carry out an approved project or activity in support of a public purpose that does not directly benefit the government. No substantial programmatic involvement with the recipient occurs during performance of the financially assisted activities. Cooperative agreements are used when there will be substantial Federal programmatic involvement, meaning that AHRQ program staff will collaborate or participate in project or program activities as specified in the Notice of Grant Award. For the purpose of this report, the term “grant” is used to include both grants and cooperative agreements.

Grant proposals are submitted in response to AHRQ’s issuance of a funding opportunity announcement (FOA). One-time FOAs are known as request for applications (RFAs), and recurring FOAs are known as program announcements (PAs). There have been three major funding initiatives funded by the Portfolio: 1) Transforming Health Care Quality through Information Technology RFAs, 2) Ambulatory Safety and Quality RFAs, and most recently 3) Health IT PAs. There are also other funding categories that contribute to the Portfolio’s body of research, such as those funded through

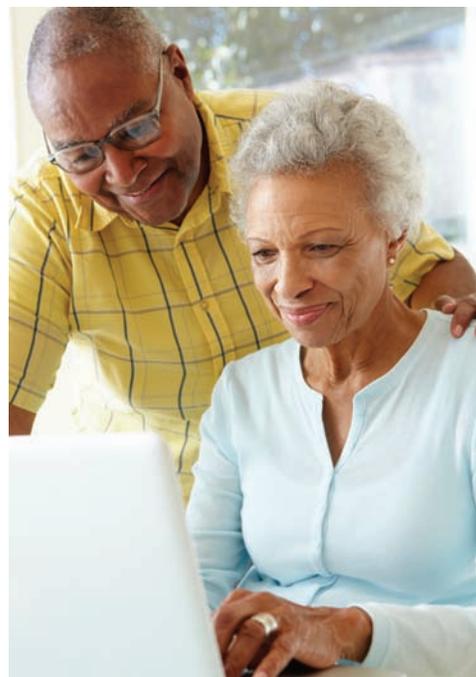
the Centers for Education and Research on Therapeutics (CERTs) and the Health Services Research Dissertation (R36) grant program. The funding initiatives are outlined below and described in more detail in Appendix B.

Transforming Health Care Quality through Information Technology (THQIT) RFAs.

The THQIT projects, awarded in 2004 and 2005, were designed to support different aspects of organizational and community-wide health IT implementation-related activities, elucidate various stakeholders’ perspectives, and/or demonstrate the value of health IT implementation and use, particularly in rural hospitals and community-based health care settings. The THQIT initiative included 118 grants funded through four RFAs focused on planning, implementation, and evaluating the value of health IT. All 118 grants ended between 2006 and 2010.

Ambulatory Safety and Quality (ASQ) RFAs.

The ASQ initiative awarded a total of 69 grants in 2007 and 2008 to support projects that focused on patient-centered care, quality measurement, and clinical management of complex patients.



The ASQ initiative funded grants through the following four RFAs:

- ***Enabling Quality Measurement (EQM) Through Health IT RFA (HS-07-002):*** Intended to develop safety and quality measures in ambulatory care settings, automate quality measurement, demonstrate the ability of electronic data systems, expand potential safety and quality measures, and demonstrate improved ability to export data for reporting performance on measures and

In April 2011, AHRQ published two new health IT-related FOAs to supplement its existing FOAs and special emphasis notice (SEN). These funding opportunities are designed to fund basic health IT research and fill gaps in the field that will lead to improved design of health IT systems.

- The [*Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health Information Technology \(IT\) \(R01\) FOA*](#) will fund research aimed at elucidating the nature of cognition, task distribution, and work in health care delivery settings. Research projects funded under this FOA will address current knowledge gaps regarding the understanding of health care providers' information needs and health care decisionmaking processes.
- The [*Understanding User Needs and Context to Inform Consumer Health Information Technology \(IT\) Design \(R01\) FOA*](#) will fund projects that will help build a knowledge base about consumers' personal health information management needs and practices and related design principles. Project results should lead to a better understanding of user needs and how their findings will impact consumer health IT design.

improvement. All 17 grants awarded through this RFA in 2007 were closed by the end of 2011.

- ***Enabling Patient-Centered Care (PCC) Through Health IT RFA (HS-07-007):*** Designed to fund grants to investigate novel methods or evaluate existing strategies for using health IT to create or enhance patient-centered models of care in the ambulatory setting. Sixteen total grants were awarded in 2007 and will end by 2012.
- ***Improving Quality Through Clinician Use of Health IT (IQHIT) RFA (HS-07-006):*** Designed to investigate novel methods or evaluate existing strategies for clinician use of health IT in ambulatory settings to improve outcomes through more effective clinical decision support, medication management, or care delivery. Twenty-four total grants were awarded in 2007 and will end by 2012.
- ***Improving Management of Individuals with Complex Healthcare Needs through Health IT RFA (HS-08-002), also referred to as "Management of Complex Patients" (MCP):*** Served to demonstrate the ability of health IT to assist clinicians, practices, systems, and patients and families in improving the quality and safety of care delivery for individuals with complex health care needs in ambulatory care settings, particularly in high-risk care transitions. Twelve total grants were awarded in 2008 and will end by 2013.

Health IT Funding Opportunities. In September 2008, AHRQ issued three PAs designed to help achieve measurable and sustained improvements in the quality and safety of health care in ambulatory settings and in transitions of care through the development, implementation, and use of health IT. The funding opportunities (R03, R21, and R18) offer applicants incremental support for the conduct of increasingly complex health IT research

projects. A total of 54 projects have been funded through these program announcements. New proposals for the R03 and R21 FOAs are still being accepted by AHRQ, while the R18 FOA closed in May 2011. The first grants of these FOAs were awarded in September 2009. The following are general overviews about each of the FOAs:

- ***Small Research Grants to Improve Healthcare Quality through Health IT (R03) (PAR-08-268)***: Supports different types of small research studies including: 1) pilot and feasibility or self-contained health IT research projects, 2) secondary data analysis of health IT research, and 3) economic prospective or retrospective analyses of health IT implementation. A total of nine projects have been awarded under this initiative.
- ***Exploratory and Developmental Grant to Improve Health Care Quality through Health IT (R21) (PAR-08-269)***: Provides funding for health IT exploratory and developmental research projects that support the conduct of short-term preparatory, pilot, or feasibility studies. The R21 grants are intended to be more comprehensive and broader in scope than the relatively smaller, self-contained health IT research projects supported by the health IT R03 FOA. A total of 24 R21 projects have been awarded since 2009.
- ***Utilizing Health IT to Improve Health Care Quality Grant (R18) (PAR-08-270)***: Supports demonstration research grants that study health IT implementation and use to improve the quality, safety, effectiveness, and efficiency of health care in ambulatory settings and transitions between care settings. A total of 21 R18 projects have been awarded since 2009. This PA closed in May 2011. Researchers can submit new proposals to the [AHRQ Health Services Research Demonstration and Dissemination Grants](#) FOA (PA-09-071).
- ***Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (P50) RFA (HS-10-016)***: P50 grants focus on applied research with the objective of developing sustainable and reproducible strategies to translate research into practice effectively and efficiently. There is one grant in this category that was funded beginning in 2011 for up to 5 years to carry out community-based participatory research on the use of communication and health IT information to improve the health status of, and health-related services provided to, older adults. One project was funded through this RFA, which is now closed.

Other Health IT-Funded Grants.

In addition to the grants described above, the Health IT Portfolio funds additional grants with a health IT focus, which are solicited through the following FOAs:

- ***Career and Dissertation Awards (R36, K01, K08)***: In 2008, AHRQ published a Special Emphasis Notice (SEN) (NOT-HS-08-014), to fund Career Development (K01, K02, K08) and Dissertation (R36) Grants focused on health IT, designed to support the next generation of health IT-focused researchers. In 2011, this SEN was reissued (NOT-HS-11-016).
- ***Conference Support Awards (R13, U13)***: AHRQ continues to support conferences through its Grant Programs to support both small (PAR-09-231, Small Grant Program for Conference Support [R13]) and large (PAR-09-257, Grant Program for Large Conference Support [R13] and [U13]) conferences to help further its mission to improve the quality, safety, efficiency, and effectiveness of health care for all Americans.



- ***AHRQ Health Services Research (R01):*** In March 2007, AHRQ issued an agency-wide FOA (PA-07-243) for ongoing extramural grants for research, demonstration, dissemination, and evaluation projects to support improvements in health outcomes, strengthen quality measurement and improvement, and identify strategies to improve access. This FOA was reissued in 2009 (PA-09-070).
- ***Centers for Education and Research on Therapeutics (CERTs) (U18, U19):*** AHRQ was given responsibility for administering the CERTs demonstration program authorized by Congress as part of the Food and Drug Administration Modernization Act of 1997 (Public Law 105-115). CERTs conduct research and provide education to advance the optimal use of drugs, medical devices, and biological products; increase awareness of the benefits and risks of therapeutics; and improve quality while cutting the costs of care.

Contracts

A contract is an agreement that is initiated by the Government to, under specified terms, acquire a product or service. The Health IT Portfolio uses various contract mechanisms to solicit requests for proposals (RFPs), including one-time RFPs and requests for task orders (RFTOs) when a master contract has been issued under an Indefinite Delivery Indefinite Quantity (IDIQ). Master contracts are a special type of RFP that are issued to a group of well-qualified contractors who are then eligible to compete for a subsequent series of RFTOs. RFTOs are provided to master contract awardees for a particular program, such as the Primary Care Practice Based Research Networks.

1. National Resource Center (NRC) for Health IT Contracts.

The NRC contracts support AHRQ's mission of developing and disseminating evidence and evidence-based tools on how health IT can improve health care quality, safety, and efficiency. The NRC is a resource for research findings, best practices, lessons learned, and funding opportunities for health IT researchers, implementers, and policymakers. The NRC also plays a pivotal role in supporting AHRQ's management of the Health IT Portfolio. Thirty-two master contractors currently support the diverse needs of the NRC across the following four domains:

- **Domain 1** – Health IT Program Management, Guidance, Assessment, and Planning.
- **Domain 2** – Health IT Technical Assistance, Content Development, and Program-Related Projects and Studies.
- **Domain 3** – Health IT Dissemination, Communication, and Marketing.
- **Domain 4** – Health IT Portal Infrastructure Management and Web Site Design and Usability Support.

2. Health IT Contracts.

In addition to the NRC, AHRQ funds a variety of knowledge-generating contracts through additional funding mechanisms. The number of AHRQ-sponsored Health IT Contracts by funding mechanism, either one-time request for proposals or master contracts through which active Health IT Portfolio task orders were issued, is included in Appendix C. The following are general overviews about each major contract mechanism.

- ***Accelerating Change and Transformation in Organizations and Networks (ACTION):*** The ACTION II network includes 17 large partnerships and more than 350 collaborating organizations. The networks conduct practice-based implementation research focused on testing or expanding the investigation of innovations that are new to the health care field; implementing interventions or improvement approaches that have been demonstrated to work in a limited type or number of settings; spreading one or more proven innovations or delivery system improvements; and evaluating and supporting sustainability. In 2011, there were nine active ACTION task order contracts funded by the Health IT Portfolio.
- ***Program Evaluation and Analysis Task Order Contract (PEATOC):*** AHRQ's PEATOC provides a mechanism to facilitate the production of focused, high-priority planning, evaluation, and other types of quantitative and qualitative analytical products for all Portfolios and crosscutting issues within the Agency. In 2011, there was one active PEATOC task order funded by the AHRQ Health IT Portfolio.
- ***Primary Care Practice-Based Research Networks (PBRNs):*** AHRQ funds primary care practice-based research networks defined as a group of ambulatory practices devoted principally to the primary care of patients and affiliated in their mission to investigate questions related to community-based practice and to improve the quality of primary care. In 2011, there were five active PBRN contracts funded by the AHRQ Health IT Portfolio.
- ***Evidence-Based Practice Centers (EPCs):*** AHRQ awards contracts to institutions to serve as EPCs. The EPCs review relevant scientific literature on clinical, behavioral, organizational, and financial topics to produce evidence reports and technology assessments. These reports are used for informing and developing coverage decisions; quality measures; educational materials and tools; guidelines; and research agendas. The EPCs also conduct research on methodology of systematic reviews. In 2011, there were four EPC task orders funded through the Health IT Portfolio.
- ***State and Regional Demonstrations in Health Information Technology (SRDs):*** In late 2004 and early 2005, AHRQ sponsored six SRD projects to create State or regional HIEs. The six projects have developed a variety of approaches to HIE with different technical, business, and governance models. Funding for the three ongoing SRDs ended in 2011.
- ***Clinical Decision Support (CDS) Services:*** In 2008, AHRQ funded two demonstration projects in support of the design, development, implementation, and evaluation of guidelines-based CDS. The demonstration projects were awarded to Brigham and Women's Hospital (Clinical Decision Support Consortium [CDSC] project) and Yale University School of Medicine (GuideLines Into Decision Support [GLIDES] project). The CDS demonstrations focus on translation of clinical guidelines and outcomes related to preventive health care and treatment of patients with chronic illnesses.

Each project was funded initially for a 2-year period, with an option for AHRQ to continue funding the projects for up to an additional 3 years. Both projects were ongoing in 2011.

Interagency Agreements

Interagency agreements (IAAs) are used to provide to, purchase from, or exchange goods or services with another Federal agency. In 2011, the Health IT Portfolio funded three projects managed by another Federal agency. One example is:

In late 2011, AHRQ and the National Science Foundation (NSF) jointly entered into a Memorandum of Understanding (MOU) that will result in an IAA that will promote the joint review and sponsorship of proposals to address the research challenges and agenda set forth in an NSF/AHRQ workshop that was held in September 2009. This particular workshop



provided a forum for experts in health services research as well as industrial and systems engineering to explore where critical areas of research in their fields intersect. Through this collaboration, NSF and AHRQ look to foster new collaborations between health services researchers and industrial and systems engineers, with a specific emphasis on the supportive role of health IT.

III. Overview of the Health IT-Sponsored Projects

AHRQ's Health IT Portfolio was comprised of 169 projects, both grants and contracts, in 2011. Through these projects, the Agency is supporting the development and dissemination of evidence on how health IT can be used to improve the quality, safety, efficiency, and effectiveness of care in a variety of health care settings. This section presents the geographic distribution of grants and contracts active in 2011 by Health IT Portfolio strategic goals, AHRQ business goals, and AHRQ lifetime funding. It also contains information on projects' spending, status of milestones, and the principal investigator's (PI's) history with Federal Grant funding, limited only to grants and not contracts. Information on project categorization of AHRQ's priority and the Health IT target populations, a sampling of project successes, and information on dissemination activities are also described.

A. Health IT Portfolio Active Projects (Grants and Contracts)

By Strategic and Business Goals¹

Within the 2011 Health IT Portfolio, 165 projects were assigned both a strategic and business goal. Definitions and examples of the various goal types are provided in Section II-C, AHRQ Business and Health IT Strategic Goals. The goal categories are:

Health IT Strategic Goals:

- Improved Decisionmaking
- Patient-Centered Care (PCC) or Health Information Exchange (HIE)
- Medication Management

AHRQ Business Goals:

- Knowledge Creation
- Synthesis and Dissemination
- Implementation and Use

Four grants funded to conduct small and large conferences were not assigned a strategic goal because the goals were not applicable.

Figure 1 illustrates the assignment of projects to one of the three possible strategic goals, defined previously in Section II-C. Of these, 80 projects (59 grants and 21 contracts) were assigned the goal of *enabling patient-centered care or health information exchange (PCC or HIE)*, 59 projects (43 grants and 16 contracts) had *improved decisionmaking* as their goal, and 26 projects (23 grants and 3 contracts) focused on *medication management* as their goal.

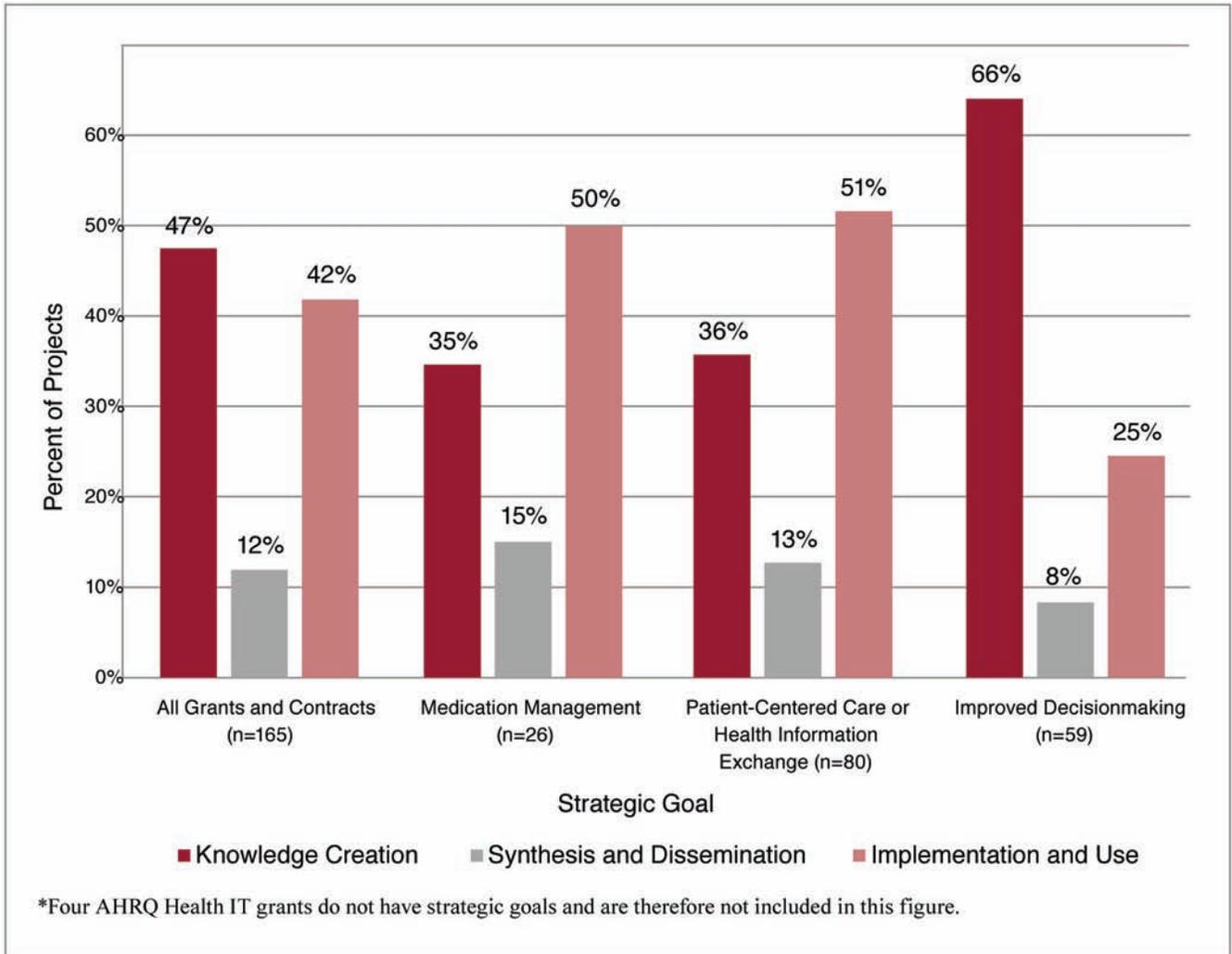
Among projects assigned a business goal, 77 projects (55 grants and 22 contracts) were assigned the goal of *knowledge creation*, while 69 projects (62 grants and 7 contracts) focused on *implementation and use*, and 23 projects (12 grants and 11 contracts) had *synthesis and dissemination* as their goal. While the majority of active projects were assigned to the *knowledge creation* business goal (47 percent), the intersection of business and strategic goals is also depicted in Figure 1. This figure illustrates that *knowledge creation* was not the predominant business goal among projects that were assigned the strategic goal of either medication management or PCC or HIE. Rather, the *implementation and use* business goal was more predominant in both those groups.

¹ Four projects (all grants) were not assigned a specific Health IT strategic goal. Therefore, where applicable, numbers do not add up to the total number of projects, 169.

However, *knowledge creation* was nearly three times more likely to be the assigned business goal among projects with the *improved*

decisionmaking strategic goal, thus making this business goal the most common across all active projects.

Figure 1: AHRQ-Sponsored Health IT Grants and Contracts as of 2011, by Strategic and Business Goals *

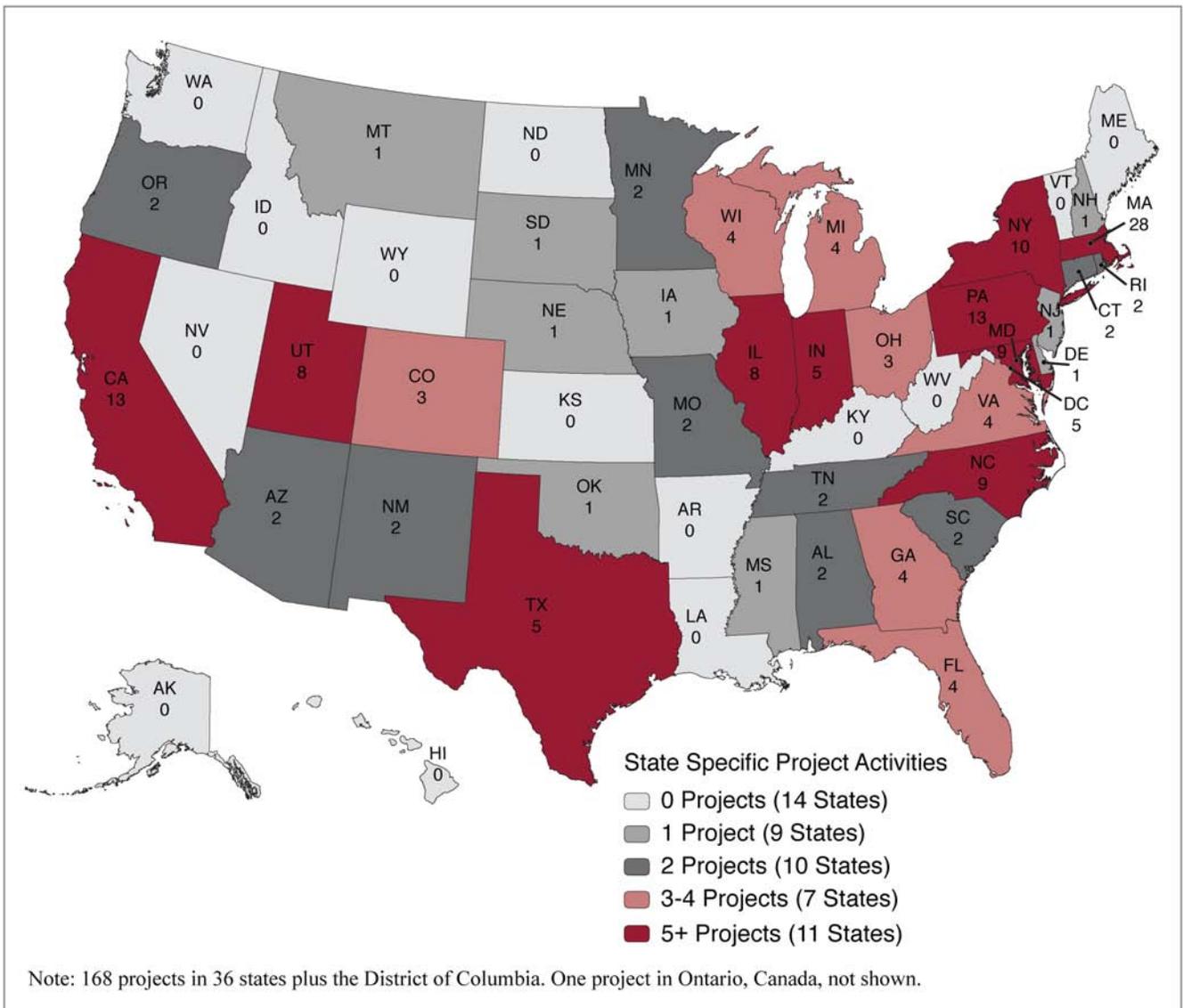


Geographic Distribution of Active Projects

In 2011, active projects were awarded to organizations located in 36 States and the District of Columbia (see Figure 2). One project was awarded to an institution in Ontario, Canada.

Massachusetts, with 28, was the State with the highest number of active health IT projects. California and Pennsylvania, with 13 in each State, had the next-highest level of active health IT projects, followed by New York with 10, and Maryland with 9.

Figure 2: Number of Active Projects Sponsored by AHRQ’s Health IT Portfolio as of 2011 by State



B. Grant Terms and Counts

Term of Grants

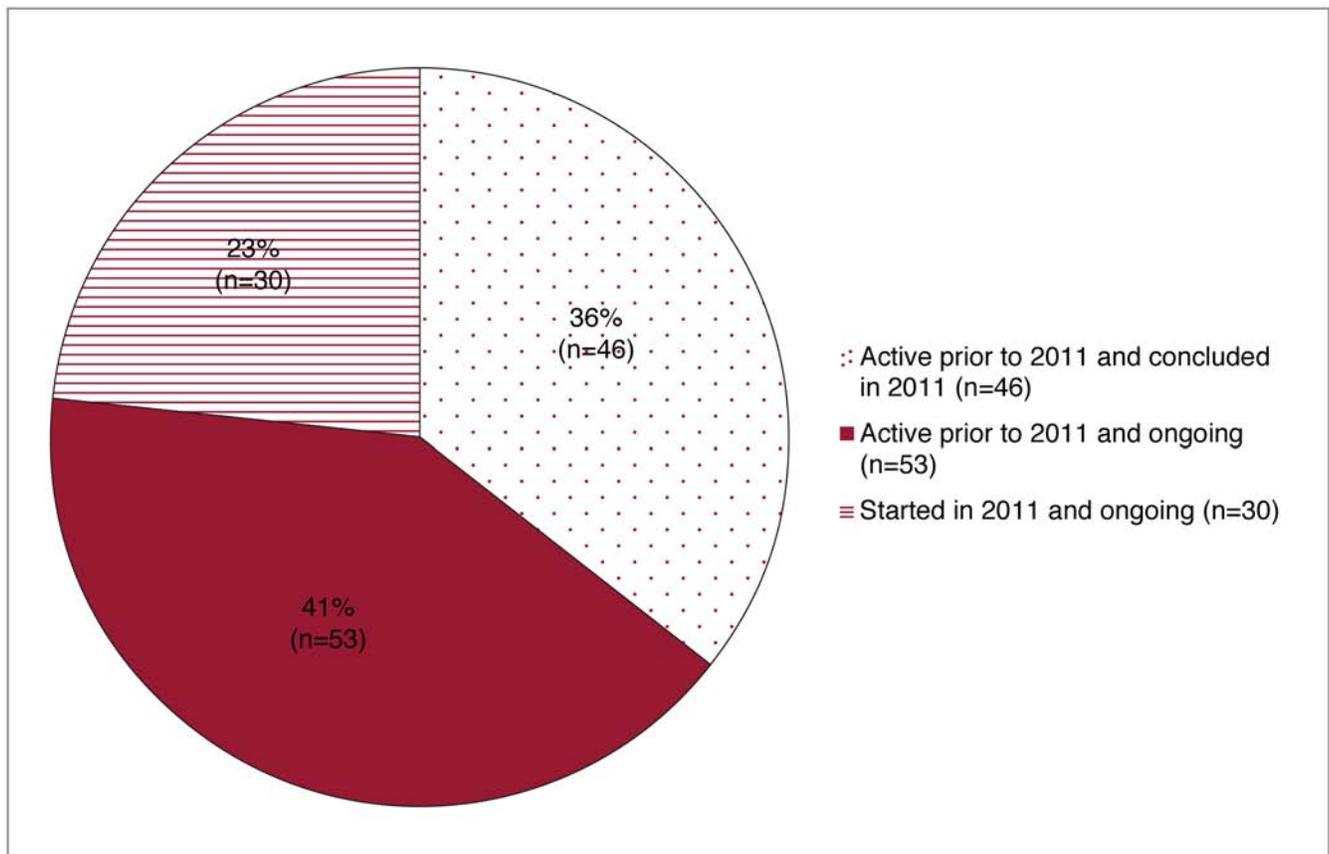
Maximum project periods for grants are specified in each RFA or PA. All of the Health IT Portfolio-sponsored grants active in 2011 were multi-year grants except for two R03 grants, two Health Services Research Dissertation (R36) grants, and two R13 grants, which are all 1-year awards.

Grants that are issued under expanded authority² are able to request a no-cost extension³. Requests can be made 1 month before the initial project

end-date to extend the project period for up to 12 months, as long as there are no changes in scope. Grants, including cooperative agreements that were not issued under expanded authority may request no-cost extensions of up to 12 months.

Figure 3 shows the status of grants in terms of how many projects that began prior to 2011 concluded or remained ongoing at the year's end, as well as how many new grants began in 2011. As demonstrated in Figure 3, the majority of the grants (53 projects, or 41 percent) were ongoing through the entire year; 30 grants (23 percent) began; and 46 grants (36 percent) ended.

Figure 3: Health IT Grants as of 2011, by Term of Grant



² Operating authorities provided to grantees that waive the requirement for agency prior approval for specified actions.

³ An extension of the period of performance beyond the expiration date to allow the principal investigator to finish a project, with no additional cost to the government.

Grants: Lifetime AHRQ Funding by Term of Grant and Strategic and Business Goals

Lifetime AHRQ funding refers to the total support (direct plus indirect costs) that AHRQ obligates to a grant during the project period, as long as the grantee’s performance indicates continuation of the grant.

Among the 125 grants assigned a strategic goal and active in 2011, total AHRQ funding equaled

\$110.7 million. Of these grants, 59 represented the most-commonly assigned strategic goal, *enabling PCC or HIE*, accounting for \$57.8 million in lifetime AHRQ funding (see Table 1). Twenty-three grants were assigned the goal of *medication management*, totaling \$24.1 million in lifetime AHRQ funding; and the 43 grants with *improved decisionmaking* as the goal accounted for \$28.8 million in lifetime AHRQ funding.

Table 1: Counts and Lifetime AHRQ Funding for Active Health IT Grants as of 2011, by Term of Grant and Strategic Goals*

Grant Term	Medication Management		Patient-Centered Care or Health Information Exchange		Improved Decisionmaking		Total	
	Number of Projects	AHRQ Funding**	Number of Projects	AHRQ Funding**	Number of Projects	AHRQ Funding**	Number of Projects	Total AHRQ Funding** (%)
Active prior to 2011; concluded in 2011	15	\$15.9	19	\$19.6	11	\$9.0	45 (36%)	\$44.5 (40%)
Active prior to 2011; ongoing	5	\$3.2	28	\$22.9	20	\$15.0	53 (42%)	\$41.1 (37%)
Began in 2011; ongoing	3	\$5.0	12	\$15.3	12	\$4.8	27 (22%)	\$25.1 (23%)
Total	23 (18%)	\$24.1 (22%)	59 (47%)	\$57.8 (52%)	43 (34%)	\$28.8 (26%)	125 (100%)	\$110.7 (100%)

*The four AHRQ Health IT grants without strategic goals are not included in this table.

**In millions of dollars. Due to rounding, total AHRQ funding values may not equal the sum of their respective columns or rows.

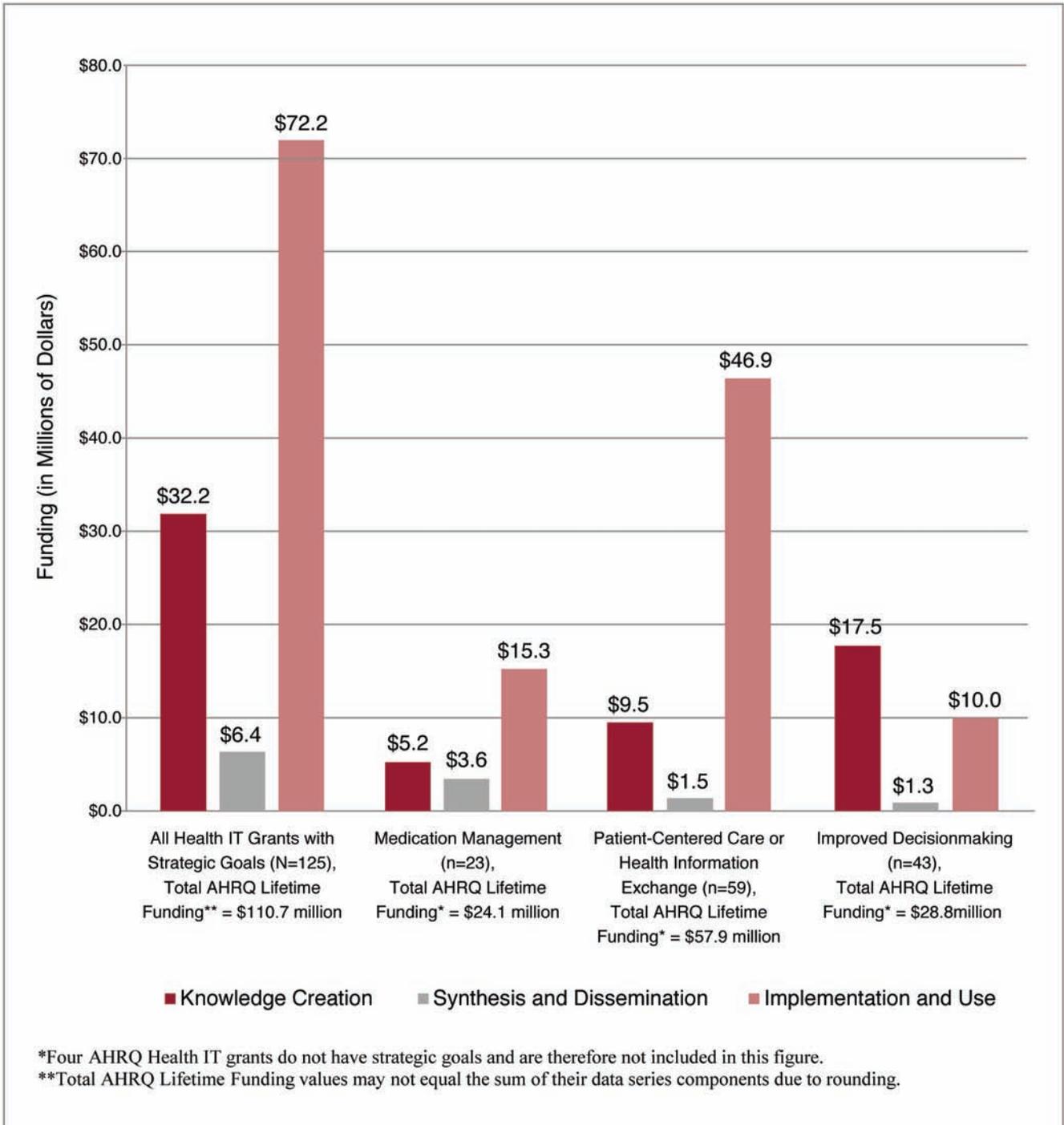
The distribution of AHRQ lifetime funding by business and strategic goals is shown in Figure 4. The lifetime funding for 117 grants that focused on either the business goal of *implementation and use* of health IT or *knowledge creation* (\$104.4 million combined) was significantly higher than

lifetime funding for the eight grants assigned the business goal of *synthesis and dissemination* (\$6.4 million). It should be noted that while the synthesis and dissemination goal represents the smallest percentage of projects and funding, dissemination of results is a requirement

specified in each FOA and notice of grant award. Therefore, each grantee is encouraged to update the Health IT Portfolio on a quarterly basis on the status of the grant, to post materials on the

NRC Web site, to notify AHRQ's OCKT when manuscripts have been accepted for publication, and to participate in AHRQ-sponsored meetings.

Figure 4: AHRQ Lifetime Funding for Health IT Grants as of 2011, by Business and Strategic Goals*



Grantees' Most Recent Self-Reported Project and Spending Status

In an effort to help AHRQ better understand the Health IT grantees' experience and performance in reaching their specific project milestones, grantees are encouraged to report their project progress and challenges to AHRQ's Research Reporting System (ARRS) on a quarterly basis. ARRS is a Web-based system that provides an online mechanism for report submission and approval. In addition to utilizing ARRS as an online mechanism to capture project updates, AHRQ uses the system to help monitor the milestone progress and spending patterns of grantees in order to understand factors that influence project process and spending. ARRS provides free-text fields to record status updates, descriptions of issues or changes, and other relevant notes. The ARRS reporting tool also includes categorical variables for grantees to indicate the extent to which they are on track in reaching overall milestones and spending plans. Since these self-characterizations are reported quarterly, variation may occur from quarter to quarter for a given project.

The ARRS reporting template prompts grantees to indicate their overall progress status and spending status as one of the following for each category:

The categorization of AHRQ-sponsored health IT grantees' last self-reported overall progress status in 2011 is reflected in Figure 5. Not all grantees are required to report in ARRS, but of those who do, most self-reported their status on schedule. However, 11 grantees who were prompted to do so did not submit an ARRS progress report in 2011, so those grantees are not included in the totals within Figure 5. Another 25 projects consisting of training grants (K-awards and research dissertation grants [R36]) and other Health IT grants (e.g., conference support grants) are not prompted to report progress on a quarterly basis in ARRS and are therefore also not included in the totals within Figure 5.

AHRQ recognizes that through the course of the grant process unexpected delays—such as loss of key personnel; additional time to ensure the institutional review board's (IRB's) approval of plans for protection of human subjects; or delays in software development, installation, or interfacing with pre-existing software—may temporarily delay achievement of research milestones and upend spending plans. Overall, the majority (87 percent) of project teams reported their progress as either “completely on track” or “mostly on track.” Only 13 percent reported progress as “on track in some respects but not others” and no project teams reported being stalled in their progress.

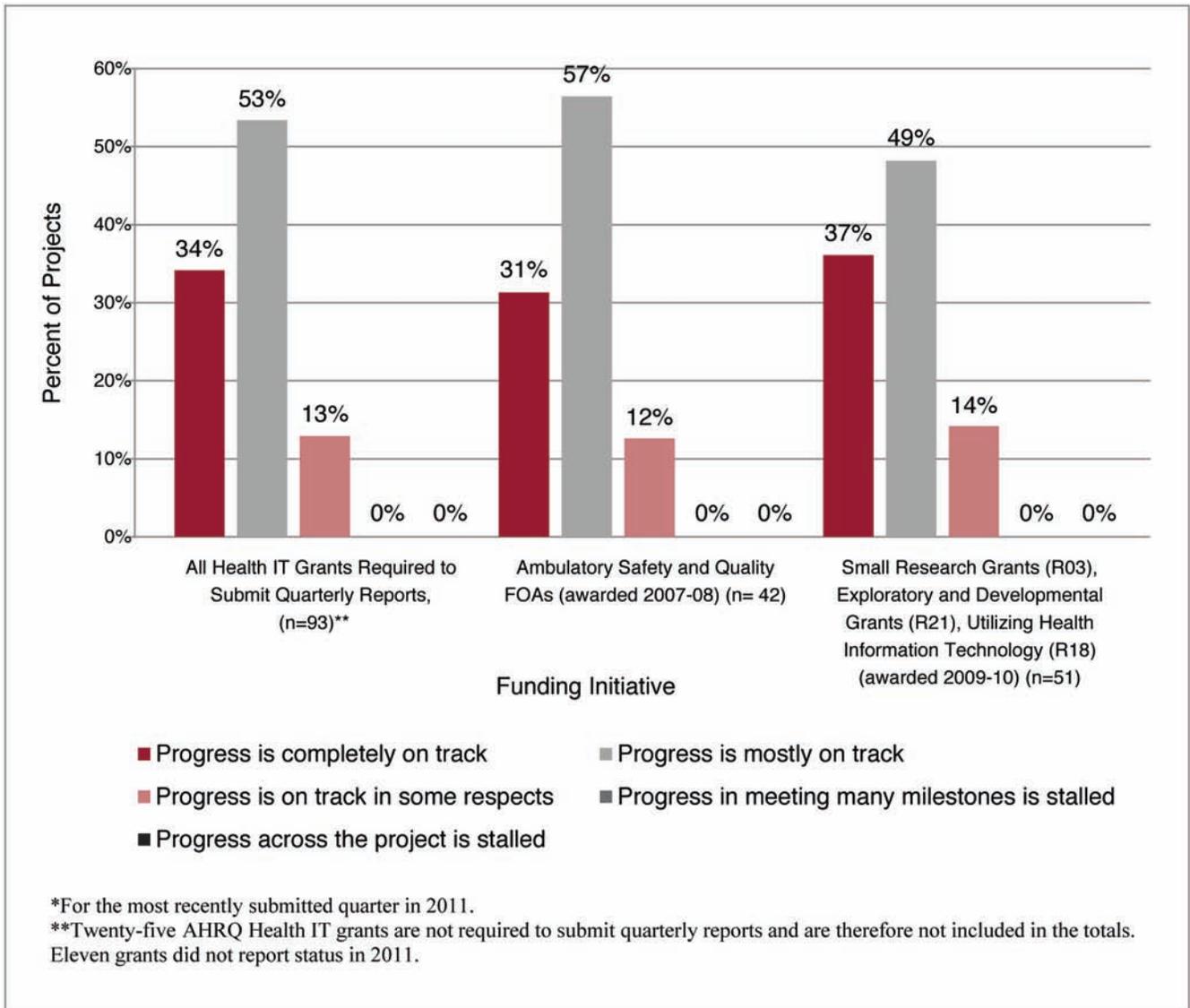
ARRS Progress and Budget Status Categories

Progress Status	Budget Status
Completely on track	Significantly underspent by more than 20 percent
Mostly on track	Somewhat underspent by approximately 5 to 20 percent
On track in some respects but not others	Spending roughly on target
Meeting many milestones is stalled	Somewhat overspent by approximately 5 to 20 percent
Stalled across project	Significantly overspent by more than 20 percent

In addition to reporting in ARRS, grantees participate in quarterly calls with John Snow, Inc. (JSI), a Domain 2 contractor tasked with the monitoring and reporting of the Health IT Portfolio-funded projects. During these calls, grantees are asked to expand on information collected in ARRS including information on

overall project progress and individual project milestones. All grantees with reported delays in achieving specific milestones identified alternative solutions to overcoming challenges or anticipated that they would request a no-cost extension to complete the project.

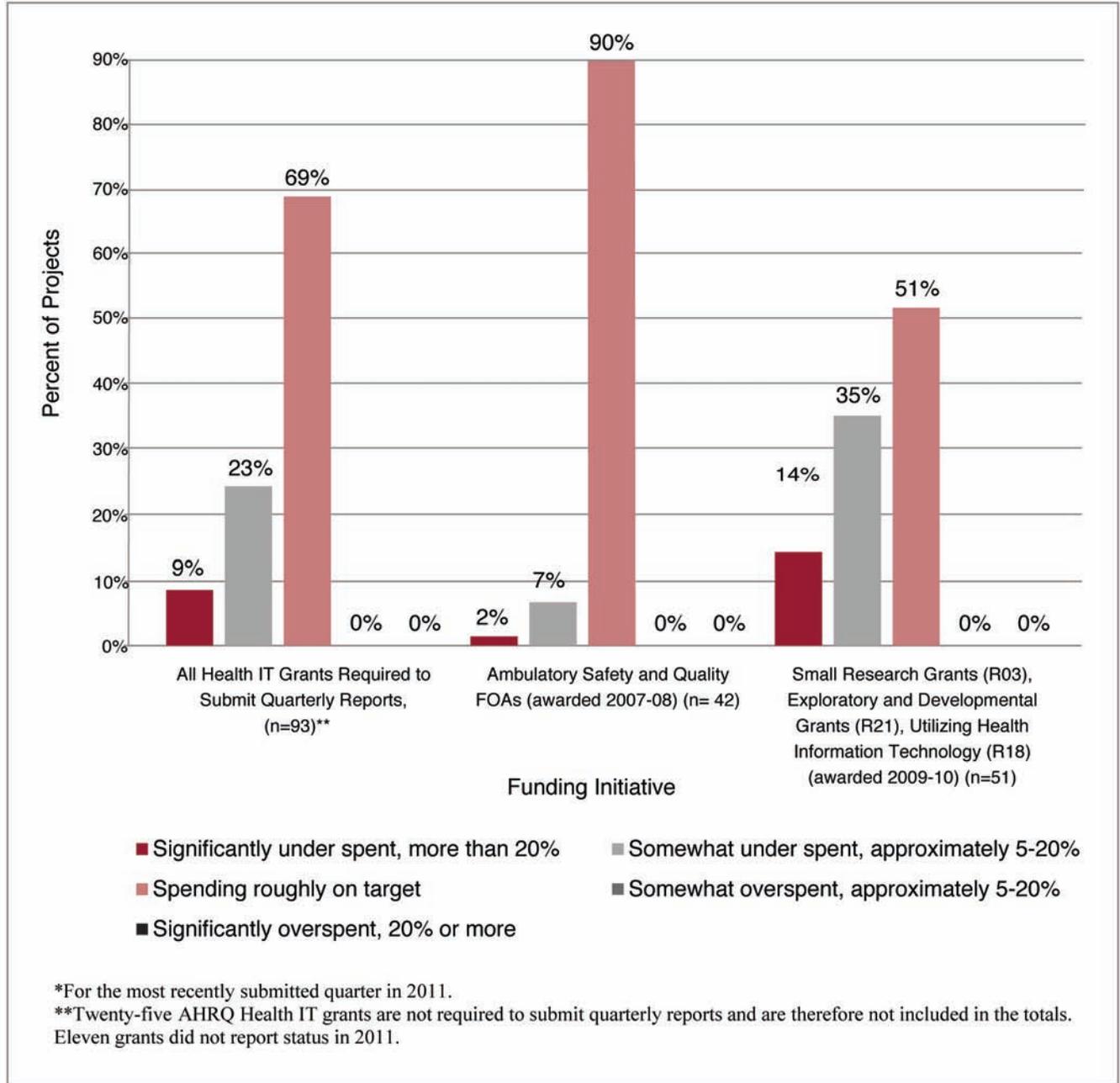
Figure 5: AHRQ-Sponsored Health IT Grantees' Self-Reported* Status Regarding Overall Goals as of 2011, by Funding Opportunity Announcement



Similarly, the categorization of AHRQ-sponsored health IT grantees' last self-reported budget status in 2011 is reflected in Figure 6. While

reporting of spending levels through ARRS is voluntary, multi-year projects are funded on an annual basis and grantees must submit an annual

Figure 6: AHRQ-Sponsored Health IT Grantees' Self-Reported* Spending as of 2011, by Funding Opportunity Announcement



noncompeting continuation application, using the Public Health Service Form 2590⁴. In this form, grantees are asked to provide a budget justification, information on other support for key personnel, and current institutional review board certification.

According to the most recent ARRS reports from 2011, the majority of grantees (69 percent) reported their spending as on target, while the remaining grantees reported being either moderately or significantly underspent. Underspending was most often attributed to delays in project implementation (e.g., hiring staff, awaiting IRB approval), or technology development. Notably, grantees appear to be sound fiscal managers of their grant funding, as evidenced by the lack of overspending reported.

C. Challenges Across Projects

Along the spectrum of a project's life cycle, from its beginning through to completion, there are a variety of challenges that can potentially occur. In ARRS or during quarterly calls with JSI, grantees reported a total of 148 issues or challenges during 2011. Due to the expertise and resourcefulness of the PIs and their teams involved in these projects, these challenges were often overcome without any long-term negative impact on the research being conducted. Often, the only major impact was the PI needing a no-cost extension. A total of 41 projects that ended in 2011 had received a no-cost extension to complete the project, ranging from 3 months to 1 year.

While the specific scenarios behind each of the challenges were as diverse as the project teams themselves, three challenges were more commonly reported than others throughout each quarter of 2011. These specific challenges related to one of the following ARRS defined categories that are reported in ARRS or collected by JSI

during quarterly calls with grantees: 1) sample or subjects (n=27), 2) key personnel (n=15), and 3) technology (n=15). Below are some examples to illustrate each of these common challenge types and how these challenges were resolved by the project teams themselves. AHRQ-sponsored technical assistance (TA) is also a resource available to grantees and a discussion of how TA resources were utilized in 2011 is included in the following section.

Examples of Challenges Reported in 2011

Sample or Subjects: One project team experienced difficulty in recruiting study participants due to challenges in contacting potential participants via telephone. Patients without a landline phone or who frequently change their phone number were particularly hard to recruit. The inability to contact potential participants to inform them about the study led to the research team to consider additional ways to reach participants. The challenge was eventually overcome through collaboration between the study team and specific advocacy organizations that frequently interacted with the study's target population. Recruitment efforts were also aided by mailing information to potential participants.

Key Personnel: One study team had difficulty in completing the data cleaning and analysis on schedule due to changes in project staffing, particularly by losing their project statistician. Due to the level of technical analysis required, a satisfactory replacement statistician with the necessary technical expertise was difficult to find. Eventually, after an extensive personnel search, the project PI identified a qualified candidate. The project was able to regain momentum and successfully completed the analysis phase in a no-cost extension period.

Technology: One research team realized a vendor-based configuration error had been

4 <http://www.ahrq.gov/fund/noncomp.htm>

made in their system that resulted in incorrect calculations; in this case the measure was the length of physical activity performed by subjects. To address the technical error, the researchers thoroughly investigated all their physical activity tracking data compiled to date. The due diligence on behalf of the project team in reviewing all the data allowed them to identify the necessary correction in the system's configuration settings, ensure that the correction was made by the software vendor, and establish a protocol to monitor and prevent a similar type of error from being made in the future.

D. Technical Assistance

AHRQ provides TA to health IT grantees to help them achieve their research and grant objectives and complete their projects within the allotted time. AHRQ's TA program includes a wide range of resources and tools to help grantees overcome obstacles and disseminate their findings.

AHRQ funds TA through an NRC contract with Booz Allen Hamilton (Booz Allen). Booz Allen staff responds to specific TA requests from grantees and provides assistance in either one-on-one or one-to-many scenarios. A variety of TA resources are available, but they generally fall into two categories: grantee-specific TA or multi-grantee TA. Below are examples of these categories and types requested during the year.



Grantee-Specific TA

The purpose of one-on-one grantee-specific TA is to ensure the progress and on-time completion of health IT-funded grant projects. Specifically, grantee-specific TA fosters the timely delivery of discrete assistance so that challenges and barriers to the conduct of health IT research are addressed. TA can be requested by a PI, another project team member, or by AHRQ staff on the project's behalf. Once a TA request has been submitted, the TA provider contacts the project team to gather detailed information pertaining to the request. This followup helps the TA provider determine whether the request is in scope for TA and to identify the necessary resources to respond to the request. In 2011, 14 TA requests were received. One additional request was out of scope for TA assistance. The frequency, request type, and an example for each are listed in Table 2.

Table 2: 2011 One-on-One Technical Assistance Activities*

2011 TA Requests	TA Category	Example
4	<u>Dissemination</u> <ul style="list-style-type: none"> • Sharing information versus exclusivity of findings • Strategies for submitting manuscripts and choosing the publication outlets • Preparing reports and manuscripts • Message development for media and the general public • Scope issues • Strategic partnerships 	Request for general support with dissemination process.
3	<u>Methodology</u> <ul style="list-style-type: none"> • Measurement, metrics, analytics • Surveys 	Request for assistance in identifying survey instruments that could be used as a reference or modified to help develop utilization and provider satisfaction questionnaires. The objective is to survey providers before and after use of a system to ascertain how helpful the system was.
2	<u>Technology</u> <ul style="list-style-type: none"> • IT infrastructure • Delays in systems implementation • Workflow 	Request for information pertaining to readiness assessments, work flow examples, successful tips, and challenges when implementing an electronic medical record / personal health record or improving the quality of data entry, and how to handle staff that are struggling with change before and during implementation.
2	<u>Recruitment / Engagement</u> <ul style="list-style-type: none"> • Patient recruitment and retention • Recruitment of priority populations • Achieving buy-in for research project from clinical and organization leaders • Engaging providers in project • Application adoption lags by providers and institutions 	Request for assistance on how to engage providers and facilities to participate in telemedicine models. Specifically the grantee was interested in engaging providers to discuss with them their mission and business model and how to incorporate both of these into telemedicine.
2	<u>Other</u> <ul style="list-style-type: none"> • Requests that do not clearly fall under one of the other established categories 	Request for information about applying for followup grants and funding.
1	<u>Privacy/Security/Protection of Human Subjects</u> <ul style="list-style-type: none"> • Data privacy concerns • Data security issues • IRB issues 	Request for information regarding social networking sites (e.g., Facebook), issues of consent, how to write the consent process, and how to approach the IRB process.

*Additional categories of available TA include grants administration, analysis protocols, and quality. Because there were no requests for these categories in 2011, they are not listed in the table.

Table 3: 2011 Multi-Grantee Specific Technical Assistance Activities

Multi-Grantee TA Category	2011 Topics and Links to Materials
Web-Based Meeting	<ul style="list-style-type: none"> • ARRS Webinar for AHRQ Health IT Grantees (January 12, 2011) • Practical Approaches to Using Electronic Health Records for Research: Challenges and Mitigation Strategies? (March 15, 2011) • Your AHRQ Grant is Ending: What's Next? (July 12, 2011)
Peer-to-Peer Teleconference	<ul style="list-style-type: none"> • Care Coordination (February 15, 2011) • Medication Reconciliation (April 28, 2011) • Dissemination (June 29, 2011)
In-Person Meeting	<ul style="list-style-type: none"> • AHRQ Annual Conference TA for Health IT Grantees Roundtables (September 20, 2011)

Multi-Grantee TA

TA for multiple grantees leverages open-forum meetings and peer-to-peer teleconferences to allow grantees to compare experiences and address common challenges, mitigating approaches, proven successful research methods, and other pertinent considerations.

- Multi-grantee TA meetings are held via Webinar teleconferences or in-person meetings. These meetings often include outside experts who provide insight on a specific topic.
- Peer-to-peer teleconferences allow grantees with similar projects to share their experiences without formal presentations.

Other Multi-Grantee TA Formats

The AHRQ Health IT TA Listserv serves as an opt-in discussion platform where grantees can collaborate, share information, and form virtual topical communities. In addition to the listserv, AHRQ provides an FAQ document that addresses grants management and administration topics and is a resource for TA providers when working with grantees on administrative-related issues.

To join the Grantee Listserv to discuss various topics and disseminate findings, please send an email request to AHRQNRC-TechAssist@ahrq.hhs.gov with “Listserv” in the subject line and “Please add me to the listserv” in the body of the email.

E. Grant Funding History

Principal Investigators

Grants and cooperative agreements are awarded to an institution rather than to a specific PI. However, the PI is the designee within the recipient organization responsible for the scientific, technical, programmatic aspects, and day-to-day management of the project. Among the 129 health IT grants active in 2011, there were 124 distinct PIs; 5 of these PIs had 2 active grants. Information used to determine a PI’s grant award history is based on data from the National Institutes of Health (NIH) Information for Management Planning, Analysis, and Coordination (IMPAC) II database. This database is used by agencies within the Department of Health and Human Services, including AHRQ.

The IMPAC II database provides information on whether or not a PI has been awarded a previous career or training grant as well as any previous federal grants.

Previous Career or Training Grants: Among the 124 unique PIs who had an active health IT-sponsored grant in 2011, 32 (26 percent) were recipients of a previously-funded career award (K-award) or training grant (T-32) to enhance their research abilities. These previous grants were funded by a range of Federal agencies including AHRQ, HRSA, the CDC, and NIH. Among these 32 PIs, 17 had received one or more K-awards, 12 had received a T-32 training grant, and three PIs had received both a K-award and a T-32 training grant. In addition to the work they are conducting on their career or training grants, many of the K-award and training grantees are mentored by more experienced investigators and also collaborate on another AHRQ-funded research grant.

Previous Federal Grants: The distribution of first-time grant PIs leading career and training grants, as well as conference support and other FOAs is provided in Table 4. The percentage of first-time grantees across the ASQ FOAs varied.

Among the ASQ initiatives, one out of the 12 PIs (8 percent) awarded an Improving Management of Individuals with Complex Healthcare Needs through Health IT grant was a first-time PI. Among the other three ASQ FOAs, none of the PIs leading Enabling Quality Measurement through Health IT grants were first-time PIs, while six first-time PIs (29 percent) were awarded Improving Quality through Clinician Use of Health IT grants, and seven first-time PIs (50 percent) were awarded Enabling Patient-Centered Care through Health IT grants.

Proportionally, there was a greater ratio of first-time PIs among the grantees funded under the Health IT PAs than the ASQ grantees in 2011. Fourteen of the 24 PIs (58 percent) who had an Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21) grant were new PIs. Five of the 21 PIs (24 percent) who had Utilizing Health Information Technology to Improve Health Care Quality (R18) grants were new. Six of the nine PIs (67 percent) who had a Small Research Grant to Improve Health Care Quality Through Health Information Technology (R03) were new PIs.

Table 4: Distribution of First-Time Grant Principal Investigators, by Funding Opportunity Announcement

Percentage of First-Time PIs	Ambulatory Safety and Quality (ASQ) FOAs
50% (7/14)	RFA-HS-07-007 ASQ Enabling Patient-Centered Care Through Health IT
29% (6/21)	RFA-HS-07-006 ASQ Improving Quality Through Clinician Use of Health IT
0% (0/3)	RFA-HS-07-002 ASQ Enabling Quality Measurement Through Health IT
8% (1/12)	RFA-HS-08-002 ASQ Improving Management of Individuals with Complex Healthcare Needs through Health IT
Percentage of First-Time PIs	Health IT PAs
67% (6/9)	PAR-HS-08-268 Small Research Grant to Improve Health Care Quality Through Health IT (R03)
24% (5/21)	PAR-HS-08-270 Utilizing Health IT to Improve Health Care Quality (R18)
58% (14/24)	PAR-HS-08-269 Exploratory and Developmental Grant to Improve Health Care Quality through Health IT (R21)
Percentage of First-Time PIs	Training and Career
50% (7/14)	NOT-HS-08-014 Special Emphasis Notice: Career Development (K01, K02, K08) and Dissertation (R36) Grants Focused on Health Information Technology (IT)
Percentage of First-Time PIs	Conference Support and Other FOAs
100% (2/2)	PAR-09-231 Small Grant Program for Conference Support (R13)
0% (0/1)	RFA-HS-07-004 Centers for Education and Research on Therapeutics (CERTs) (U18)
50% (1/2)	RFA-HS-11-004 Centers for Education and Research on Therapeutics (CERTs) (U19)
100% (2/2)	PAR-09-257 AHRQ Grant Program for Large Conference Support (R13) and (U13)
67% (2/3)	PAR-09-070 AHRQ Health Services Research (R01)
0% (0/1)	RFA-HS-10-016 Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (HIT) (P50)

F. Contract Information

In contrast to grantees, the majority of contractors are not required to report in ARRS, thus similar statistics are not available for contract projects. The following section outlines counts of projects by AHRQ business and the Health IT strategic goals and lifetime funding.

In 2011, the Health IT Portfolio had 40 active contracts with cumulative AHRQ lifetime funding of \$51.1 million. These contracts enabled individual projects to address a defined, pre-determined need. Each contract was assigned one of three Health IT Portfolio strategic goals and one of three AHRQ business goals.

Initial project duration is specified in each contract, and some contracts have a provision to support additional option years. The duration of the 40 contracts active in 2011 varied from 1 year to more than 5 years.

Figure 7 shows the status of contracts in terms of how many projects that began prior to 2011 concluded or remained ongoing at the year's end, as well as how many new contracts began in 2011. As demonstrated in Figure 7, the majority of the contracts (23 projects, or 58 percent), ended during the year, 16 projects (40 percent) were ongoing through the entire year, and one contract (3 percent) began.

Figure 7: Health IT Contracts as of 2011, by Term of Contract

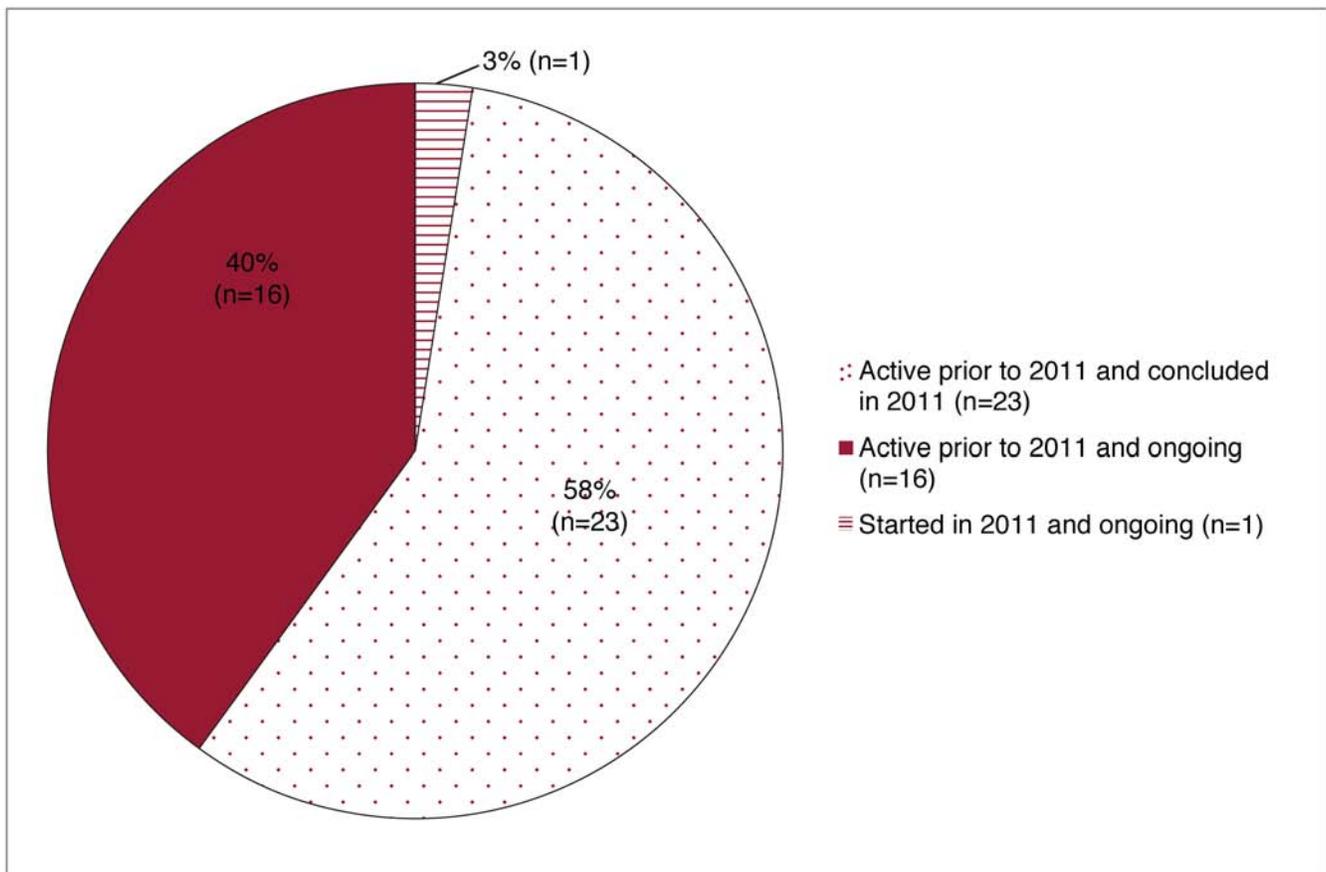


Table 5: Counts and Lifetime AHRQ Funding for Health IT Contracts as of 2011, by Health IT Portfolio Strategic Goal and AHRQ Business Goal

AHRQ Business Goal	Medication Management		Patient-Centered Care or Health Information Exchange		Improved Decisionmaking		Total	
	Number of Projects (%)	AHRQ Funding* (%)	Number of Projects (%)	AHRQ Funding* (%)	Number of Projects (%)	AHRQ Funding* (%)	Number of Projects (%)	Total AHRQ Funding* (%)
Implementation and Use	1	\$1.0	3	\$14.7	3	\$1.9	7 (18%)	\$17.6 (34%)
Knowledge Creation	1	\$0.4	11	\$4.1	10	\$21.0	22 (55%)	\$25.5 (50%)
Synthesis and Dissemination	1	\$0.4	7	\$6.0	3	\$1.5	11 (28%)	\$8.0 (16%)
Total	3 (8%)	\$1.8 (4%)	21 (53%)	\$24.9 (49%)	16 (40%)	\$24.5 (48%)	40 (100%)	\$51.1 (100%)

*In millions of dollars. Due to rounding, total AHRQ funding values may not equal the sum of their respective columns or rows.

As shown in Table 5, the greater number of contracts (n=21) and larger amount of contract funding (\$24.9 million) are associated with the Health IT Portfolio strategic goal of *PCC or HIE*. There were 16 contracts with a Health IT Portfolio strategic aim of *improved decisionmaking*, and a total of \$24.5 million funding. Health IT Portfolio support for *medication management* is lower than other categories, at \$1.8 million for three contracts.

For business goals, there were twice as many contracts (n=22, 55 percent) with a business goal of *knowledge creation* compared to *synthesis and dissemination* (n=11, 28 percent), followed by *implementation and use* (n=7, 18 percent).

The two contracts from the CDS Initiative and three contracts from the SRD Initiative make up the majority of the AHRQ contract funding in 2011. Each of the projects from the CDS Initiative were funded at \$6.2 million, had an AHRQ business goal of *knowledge creation*, had

a strategic goal of *improved decisionmaking*, and remained active through 2011. Three of the SRD projects active in 2011 and have since ended, were funded at a combined \$14.7 million, had an AHRQ business goal of *implementation and use*, and a Portfolio strategic goal of *PCC or HIE*.

G. AHRQ Target and Priority Populations

Target Populations

The AHRQ Health IT Portfolio assigns funded projects based on the target populations of their research, if applicable. These populations are listed in the summaries for each project. Table 6 outlines the frequency of projects categorized by each Health IT target population. The most common target population category was adults (71), followed by chronic care (42) and pediatric (27). Projects can be tagged on more than one category.

Table 6: Health IT Project Counts of AHRQ Health IT Target Populations

Target Population	Count of Projects
Adults	71
Chronic Care	42
Pediatric	27
General	24
Elderly	21
Racial or Ethnic Minorities	21
Diabetes	19
Medically Underserved	17
Not Applicable	17
Medicaid	16
Low-SES/Low Income	15
Hypertension	14
Safety Net	9
Cancer	8
Mental Health/Depression	8
Teenagers	8
Low Literacy	7
Coronary Artery Disease	6
Medicare	6
Obesity	6
Inner City	5
Women	6
Acute Respiratory Infections	4
Asthma	4
Chronic Obstructive Pulmonary Disease	4
Congestive Heart Failure (CHF)	4
HIV/AIDS	4
Other Conditions*	4
Uninsured	4
Veterans	4
Persons with Disabilities	2
Cerebral Palsy	1
Children with Special Health Care Needs	1
Hepatitis C	1
Kidney Disease	1
Men	1
Osteoporosis	1
Otitis Media	1
Sleep Apnea	1
Total	415

*Other conditions include atopic dermatitis and xerostomia.

Table 7: Health IT Project Counts of AHRQ Priority Populations

Priority Population	Count of Projects
Chronic Care	42
Children	29
Elderly	21
Minorities	21
Low Income	15
Women	6
Inner City	5
Disabilities	3
Men	1
Total	143

Priority Populations

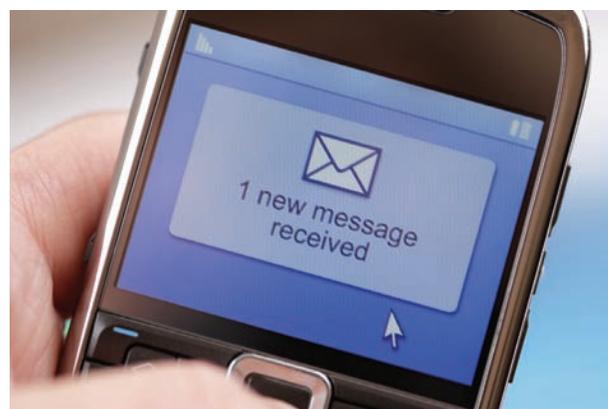
The AHRQ priority populations were specified by Congress in the Healthcare Research and Quality Act of 1999 (Public Law 106-129), which states that research should “address health care needs of the priority populations”.⁵ These populations consist of groups with unique health care needs or issues that require special focus, such as racial and ethnic minorities, low-income populations, and people with special health care needs. Table 7 outlines the number of projects categorized by each priority population. The most common priority population category was chronic care (42), followed by children (29), elderly (21), and minorities (21). Projects can be tagged on more than one category.

H. Project Successes

The projects funded by the Health IT Portfolio address important gaps in the research and relevant literature about health IT implementation and use, particularly its impact on quality, safety, and improved health care outcomes, and the applicability of those findings to other health care settings. This section provides several

examples of AHRQ-funded projects that were active in 2011 and demonstrate the range of the Health IT Portfolio’s breadth.

Using a Short Message System to Improve Health Care Quality and Outcomes Among HIV-Positive Men (Contract # 290-06-0001-7): Dr. Jennifer Uhrig from RTI International directed a project that used a short message system, otherwise known as text messaging, to promote medication adherence and appointment attendance; reduce risk-taking behaviors; and enhance social support, general health and well-being, and patient involvement. Participants were very receptive to and satisfied with the



⁵ <http://www.gpo.gov/fdsys/pkg/PLAW-106publ129/html/PLAW-106publ129.htm>

intervention and the messaging used, stating specifically that the messages were easy to understand and described them as accurate, believable, effective, clear, informative, interesting, and realistic. Using a relatively inexpensive technology and intervention with potential for wide dissemination and high impact, this intervention exemplified the use of mobile phones and text messaging as an effective health information and communication tool.

Developing and Using Valid Clinical Quality Measures for Health Information Technology with Health Information Exchange (Grant # R18 HS 017067): Dr. Rainu Kaushal from the Weill Medical College of Cornell University led an effort to advance the goal of health IT-enabled quality measurement to improve health care in an ambulatory setting. More than ever before, physicians are using EHRs and exchanging clinical data with other health care providers. Therefore, the ability to accurately measure quality from EHR data is important and presents a significant opportunity to improve quality. Dr. Kaushal validated and tested electronic quality measures at a Federally Qualified Health Center using EHR data and found the overall reliability of quality measures to be high. The study team also saw that performance on many of the measures improved over time, even though the study did not include a quality improvement intervention. This research provides lessons learned for other health care providers and facilities and is particularly pertinent to the on-going Meaningful Use Initiative which includes quality measurement as an integral component. A video detailing the successes of this project is available at: www.healthit.ahrq.gov/EQMKaushalVideo.

Harnessing Health IT to Prevent Medication-Induced Birth Defects (Grant # R18 HS 017093): Dr. Eleanor Schwarz from the University of Pittsburgh led a team of researchers in the development of two CDS systems to help

providers remember to provide counseling to women about family planning services when prescribing medications that may cause birth defects. These systems were designed to address the issue that in many cases information about the risk of birth defects associated with certain medications is available; however, providers often do not provide this counseling to their patients. The two systems differed in that one generated a static alert to the provider while the other system provided tailored information and links to additional information to facilitate safe prescribing. Both CDS systems were associated with improved quality of care as measured by increases in family planning services when potential teratogens were prescribed. In other words, when patients learned about teratogenic effects of medications they were prescribed, more women chose to use contraception. The CDS was considered to be a sustainable intervention that is potentially replicable in other clinical settings.



Web-Based Intervention for Alcohol Use in Women (Grant # R36 HS 018071): With funding from an R36 Dissertation grant, Dr. Katia Delrahim-Howlett from the University of California San Diego, evaluated a health IT intervention designed to reduce risky alcohol use among low-income women. The intervention involved a Web-based screening tool that assessed alcohol consumption and provided personalized

feedback related to each participant's alcohol use and the health risks associated with risky alcohol use, including information about fetal alcohol spectrum disorders. The study found that Web-based assessment alone is effective in reducing risky alcohol consumption and in sustaining that effect. More than 70 percent of participants reported a reduction in risky alcohol use whether they received personalized feedback or generic feedback during the Web-based screening and intervention program.

Improving Quality in Cancer Screening: The Excellence Report for Colonoscopy (Grant # R18 HS 017017): Dr. Judith Logan from the Oregon Health and Science University led the effort to create and evaluate a quality measurement program for gastroenterologists using data from a specialty EMR for gastrointestinal endoscopy. Effectiveness of colonoscopy screening procedures depends on providing high quality examinations that result in accurate diagnoses and few complications. In this project, endoscopists in 16 States were

provided secure Web-based reports on the quality of the colonoscopies they performed based on current recommendations from professional societies. Clinicians were found to be very receptive to the receipt of the reports on their performance; although, in this short study significant improvement was not indicated in the quality of care provided. However, significant lessons were learned about issues relating to workflow, interoperability, and reporting. There is also ongoing work being done to make it possible to share data across different systems and report data in a consistent fashion. A video detailing the successes of this project is available at: www.healthit.ahrq.gov/EQMLoganVideo.

These projects are a sample of the diverse research that the Health IT Portfolio funds. They demonstrate the positive impact of health IT implementation and use on changes in quality, safety, and improved health care outcomes. [Individual featured stories](#) for some of these projects have been developed and are available as featured projects on the NRC Web site.

I. Dissemination of Health IT Information

An important aspect of AHRQ's Health IT Portfolio is its mission to disseminate the information generated by its programs and partners. In 2011 there were a range of presentations and publications developed by members of the Health IT Portfolio team as well as the contractors and grantees. These were made available through various dissemination venues, including AHRQ's 2011 Annual Conference and the NRC Web site.

AHRQ's Annual Conference

The annual conference, titled "Leading Through Innovation and Collaboration," was held September 18-21 in Bethesda, Maryland. The conference was designed to showcase the best of the Agency's research and provide examples of how that research is being implemented at all levels in health care delivery. Presentations represented several major themes and health IT was a significant cross-cutting topic.

The conference featured presentations in six major tracks:

1. Making Care Safer by Reducing Harm Caused in the Delivery of Care.
2. Ensuring That Each Person and Family Are Engaged as Partners in Their Care.
3. Promoting Effective Communication and Coordination of Care.
4. Promoting the Most Effective Prevention and Treatment Practices for the Leading Causes of Mortality, Starting With Cardiovascular Disease.
5. Working With Communities to Promote Wide Use of Best Practices to Enable Healthy Living.
6. Making Quality Care More Affordable for Individuals, Families, Employers, and

Governments by Developing and Spreading New Health Care Delivery Models.

Health IT Portfolio grantees and contractors gave several presentations, including the following:

Chuck Thompson, Ph.D., from RTI International, the PI on the Barriers to Meaningful Use in Medicaid project (Contract # 290-07-10079), participated in a panel discussion that outlined the motivation for studying this issue, and the prior research on the facilitators and barriers of EHR use among Medicaid providers. Presenters summarized prior research and led an interactive discussion of barriers, policy, and technical assistance solutions. Next steps for the project team will be to conduct focus groups in four States as well as "virtual" focus groups. The subsequent report is intended to inform outreach and assistance to Medicaid providers as well as future Meaningful Use regulations.

Neil Fleming, Ph.D., C.Q.E., from Baylor Health, presented [results](#) from his project, the Impact of Health IT on Primary Care Workflow



and Financial Measures project (Grant # R03 HS 018220), which set out to estimate the cost and workflow impact of rapid implementation of

an EHR in primary care practices, reducing the uncertainty that health care providers currently face when considering EHR adoption. He summarized their results revealing that while there are short term decreases in workflow and financial measures after EHR implementation, the loss of revenue and productivity are not as burdensome as feared by practices considering EHR adoption.

The [presentation](#) by Terry Field, D.Sc., "Estimating the ROI for Computerized

Clinical Decision Report,” described the costs of developing an automated alert system to provide primary care providers with notification of hospital and skilled nursing facility discharge, new drugs added during hospital stays, recommendations related to dosing and monitoring, and reminders to support staff to schedule followup visit, as well as savings due to the intervention in the form of switching orders to lower-cost medications and reduced costs associated with adverse drug events (Grant # R18 HS 017817). She reported that the development costs of these interventions are significant and often require extensive time from clinicians. In addition, there are immediate direct cost savings related to switching to lower cost medications; however, savings from adverse events are likely to be substantial.

These presentations along with many others provided an opportunity for AHRQ project officers, grantees, and contractors to disseminate project results, share lessons learned, and build on each other’s work. More information on these presentations and the other conference sessions, as well as general conference information, is available at: www.ahrq.gov/about/annualconf11/.

National Web-Based Teleconferences

The National Web-Based Teleconferences conducted throughout 2011 spanned a range of topics and were well attended by a variety participants, including providers, researchers, and health IT professionals. The 2-hour sessions allowed for informative presentations and interactive discussions. Post-presentation materials for all teleconferences are available on the NRC Web site under [Events](#).

- The [Preventing Errors and Promoting Safety Through Better Medication Management](#) teleconference (February 16, 2011) was attended by 50 participants. Presenters

described efforts to prevent patient safety errors through health IT and tools.

- Over 100 participants attended the [Putting the Patient Back in Patient-Centered Care](#) teleconference (March 30, 2011) to learn about the use of health IT applications to improve patient involvement in the management of their health and health care.
- Sixty-five individuals participated in the [Quality Metrics and Measurement](#) teleconference (April 28, 2011) where presenters described how current quality measurement systems will be used under the Patient Protection and Affordable Care Act and what changes will be implemented, the role of health IT in quality measurement and reporting, and how health IT can be used to improve health care quality.
- Over 300 individuals participated in the [Using Health IT Chronic Disease Management](#) teleconference (June 21, 2011). Presenters described the use of health IT applications to improve management of the care for patients with chronic illnesses through the use of EHR interfaces.
- The [Findings from the Evidence-Based Practice Centers for Health IT](#) teleconference (July 20, 2011) was attended by 250 participants. Investigators from three of the EPCs provided an overview of three Health IT Portfolio-funded evidence-based reports. The EPC reports were based on rigorous, comprehensive syntheses and analyses of the scientific literature and highlight the state of the evidence on medication management using health IT, decision support tools, and consumer health informatics applications and their respective effect on the quality of care.
- Over 120 individuals participated in the [Utilizing Health IT to Improve Medication Management for the Care of Elderly Patients](#) teleconference (August 18, 2011). Presenters

provided an overview of the unique care challenges elderly patients present in hospital, home, or nursing care settings and then described the innovative ways that care is being provided to the elderly using health IT.

Outputs

During 2011, grantees reported a total of 344 outputs, the majority of which (102) were peer reviewed publications. The outputs categorized as “other” included internal grantee documents and outputs such as a Web-based video demonstrating a recent version of a system interface. Grantee outputs are categorized in Table 8.

During 2011, there were a total of 23 outputs from contractors, the majority of which were peer reviewed (8) and non-peer reviewed (8) publications. Contractor outputs are categorized in Table 9.

Outputs from the grant and contract projects are reviewed for inclusion into one of three tools on the NRC Web site. Surveys and other data collection tools developed for the projects may be included in the Health IT Survey Compendium, a set of publicly available health IT surveys. Other grantee and contractor internal documents such as project schedules, business associate agreements, and requests for proposals are reviewed for the AHRQ Funded Project Resource Archives.

In 2011, a new tool was released on the NRC Web site. The [AHRQ Health IT Projects Publication Database](#) serves as a central repository for publications. The database provides the name of the project, the principal investigator’s name, the publication type, and a link to the full citation for the publication. Users can search the database



Table 8: Grantee Tools, Products, and Other Outputs from 2011

Type of Tool/Output	Count
Publication (peer reviewed)	102
Presentation	77
Poster	41
Internal Documents	27
Surveys	20
Final Report	18
Other	18
Tool/Product	14
Manuscript*	8
Data Collection Tools	6
Abstract	5
Publication (non-peer reviewed)	4
News article	2
Patent	1
Press release	1
Total	344

*Including manuscripts submitted, but not yet accepted for publication.

Table 9: Contractor Tools, Products, and Other Outputs from 2011

Type of Tool/Output	Count
Publication (non-peer reviewed)	8
Publication (peer reviewed)	8
Surveys	4
Presentation	2
Poster	1
Total	23

by different categories to find articles that may be pertinent to their own research projects. At the time of this report's publication, the database contains over 325 entries. Several examples of these publications are:

- Based on natural language processing, Dr. Li Zhou (Grant # R03 HS 018288) developed an automated method to facilitate the creation and maintenance of mapping between RxNorm and a health care organization's local medication terminology for interoperability and Meaningful Use purposes. The process and results were published in the [Journal of Biomedical Informatics](#).
- The National Research Council of the National Academies of Science conducted a project (Contract # AHR7128) and formed the Committee on the Role of Human Factors in Home Health Care, a multidisciplinary consensus panel of recognized experts. This panel was brought together to examine a range of behavioral and human-factors issues that have arisen due to the increasing migration of medical devices, technologies, and care practices from formal health care facilities into private homes. The committee sought to determine how current and emerging human factors knowledge and methods, as well as future research, could best be applied to improve the safety, effectiveness, cost-effectiveness, and other aspects of the quality

of health care in the home. The papers and resultant workshop summary, [Human Factors in Home Health Care: Workshop Summary](#), informed the committee's deliberations for its final report, [Health Care Comes Home: The Human Factors](#).

- Dr. Kate Lapane's paper (Grant # R18 HS 017150), [Alternatives to potentially inappropriate medications for use in e-prescribing software: triggers and treatment algorithms](#), was published in the *BMJ Quality and Safety Journal*. The paper described the development of 15 evidence-based electronic prescribing triggers and treatment algorithms for potentially inappropriate medications for older adults.

AHRQ's Office of Communications and Knowledge Transfer Dissemination Activities

Staff from the Office of Communications and Knowledge Transfer (OCKT) play a critical role in the synthesis and dissemination of findings from the Agency's research. Below is a summary of OCKT's marketing and media dissemination activities in 2011 in regard to specific deliverables from AHRQ Health IT Portfolio-funded projects.

- **Media Outreach:** In 2011, OCKT issued press releases on AHRQ-funded health IT research projects including:

- [New Study Finds E-prescribing Is Safe and Efficient, but Barriers Remain](#), published online in November in the *Journal of the American Medical Informatics Association*.
- [Connecting Local Providers to Academic Medical Centers Using Video Improved Hepatitis C Outcomes](#) published online in June in the *New England Journal of Medicine*.
- **Marketing Outreach:** In 2011, AHRQ conducted marketing outreach to key associations, Federal entities, advocacy groups, policy groups, and other stakeholders to promote relevant findings to the health IT industry. As a result, OCKT sent email announcements to various audiences including clinicians, policymakers, and implementers on topics such as:
 - **Workflow Assessment for Health IT:** In July, OCKT promoted and disseminated the [Workflow Assessment for Health IT Toolkit](#) funded by AHRQ and prepared by the University of Wisconsin-Madison's Center for Quality and Productivity Improvement. The toolkit was designed to assist small and medium sized practices in workflow analysis and redesign before, during, and after health IT implementation. It includes tools to analyze workflow, examples of workflow analysis and redesign, and others' experiences with health IT and workflow.
 - **Report on Practices, E-Prescribing and Accessing Information to Improve Prescribing Decisions:** In May, OCKT promoted and disseminated a report titled "[Physician Practices, E-Prescribing and Accessing Information to Improve Prescribing Decisions](#)." The report was funded by AHRQ and focused on how e-prescribing is being used for new prescriptions and renewals, the barriers to use, effects on pharmacies' prescription processing, and strategies to support more effective use of these features.
- **Health Care Comes Home: The Human Factors:** In July, OCKT promoted the book "[Health Care Comes Home: The Human Factors](#)" to home health design experts and health IT industry analysts. The book outlines the impact of technology, environment, policy, and human factors on the growing field of home health care.
- **Report on Improving Consumer Health IT Application Development: Lessons from Other Industries: Background Report:** In August, OCKT promoted and disseminated a report titled "[Improving Consumer Health IT Application Development: Lessons from Other Industries: Background Report](#)" to consumer health IT designers, vendors, and implementers. The report explored how creators of consumer health IT products can use common design methods, and included a special emphasis on the important ways in which the health IT application development process diverges from consumer product development.
- **GovDelivery Updates:** AHRQ continued to garner new subscribers for its health IT listserv using the GovDelivery email subscription system. In 2011, AHRQ issued over 15 updates on health IT topics to more than 45,000 subscribers, 12,000 of whom joined in 2011. Updates included the following:
 - An AHRQ study identifies impact of health IT on oral health care among groups served by Medicaid.
 - An AHRQ study that shows e-prescribing reduces medication errors.
 - Funding opportunities for modeling of health services system design.

To sign-up to receive AHRQ Health IT News and Information

- Go to [NRC Web site](#)
- Select “Subscribe to Updates,” located on the lower left corner

- **Media Coverage:** As a result of media and marketing outreach efforts in 2011, AHRQ received broad media coverage from mainstream and trade publications, including Modern Healthcare, Government Health IT, Healthcare IT News, Web MD, FierceHealthcare.com, HIMSS News, iHealthbeat, and Advance for Health Informatics.
- **Twitter:** In 2011 OCKT used Twitter to broadcast reports, findings, and initiatives to AHRQ’s 12,000 plus followers. Over 25 messages were sent regarding health IT topics and activities; collectively, these messages were retweeted more than 75 times. Some of the most popular Tweets included:
 - [July 6, 2011](#): AHRQ introduces a toolkit to help small & medium sized practices analyze workflow before & after implementing health IT <http://bit.ly/oPCKqe>
 - [July 18, 2011](#): New report discusses best practices, environmental factors, tech advances, & changes in approach & policy in home health care: <http://bit.ly/qVJy5V>
 - [July 22, 2011](#): Want to know more about how different cultures approach health care in their homes? Read this new report <http://bit.ly/qVJy5V>
- **Podcasts:** AHRQ’s [Healthcare 411](#) is a news series that features audio podcasts on consumer-oriented and timely topics such as health care quality, safety, efficiency, and health IT. Weekly, 60-second radiocasts air

on more than 1,000 radio stations nationwide and are shared with more than 700 professional organizations. Several podcasts have highlighted results from projects funded through the health IT Portfolio. The podcasts, as well as their transcripts, are available for download. In 2011, AHRQ issued the following health IT-specific podcasts:

- [E-Prescribing and Reducing Medication Costs](#): This podcast, posted on February 16, 2011, describes how e-prescribing improves safety and may lead to lower costs on certain medications.
- [Keeping Kids in School via Telemedicine](#): This podcast, posted on March 2, 2011, highlights how innovations in telemedicine allow children who need ongoing monitoring to attend school.
- [E-Prescribing](#): This podcast, posted on December 14, 2011, provides insight on how e-prescribing can make prescriptions safer for patients.
- **Meeting Exhibits:** In 2011, the AHRQ Health IT Portfolio was promoted at ten annual meetings or conferences, including:
 - Healthcare Information and Management Systems Society
 - American College of Physicians
 - American Academy of Physician Assistants
 - Academy Health
 - National Medical Association
 - American Academy of Family Physicians
 - American Medical Informatics Association
 - American Public Health Association
 - American Osteopathic Association
 - National Forum on Quality Improvement

- **E-Newsletters and *Research Activities***

- **AHRQ's Electronic-Newsletter:** This newsletter summarizes the Agency's research and programmatic activities. Featured critical topics in health IT are listed below:

- [Personal Health Records](#)
- [Health IT Enabled Medication Management](#)
- [Human Factors in Home Health Care](#)
- [Health IT Enabled Management of Chronically Ill Patients Web conference](#)
- [AHRQ Health IT Workflow Toolkit](#)
- [Effective E-Prescribing](#)

- **AHRQ's Monthly Research Activities:** *Research Activities (RA)* is AHRQ's monthly print and online newsletter that features articles and announcements on Agency products and projects and summarizes research findings from AHRQ-supported studies. During 2011, *RA* had nearly 28,000 print and more than 32,000 electronic subscribers. There were a total of 20 Health IT-related headlines in 2011 including the following:

- [Health information technology improves care and saves lives \(January 2011\).](#)
- [Parents using electronic kiosk provide more accurate clinical information than emergency room providers \(April 2011\).](#)
- [Patients with limited health literacy less likely to use an Internet portal for diabetes and other health information \(April 2011\).](#)



- [Physicians' unfamiliarity with electronic personal health records may slow their adoption \(June 2011\).](#)
- [Physicians weigh the costs and benefits of integrating e-prescribing systems with electronic health records \(June 2011\).](#)
- [Patients with type 2 diabetes express mixed reactions to a mobile phone and Web-based disease management program \(October 2011\).](#)
- [Study identifies costs of implementing electronic health records in network of physician practices \(October 2011\).](#)
- [Pediatric care providers identify desired characteristics for computerized flu vaccination alerts \(December 2011\).](#)

IV. Conclusion

As demonstrated throughout this report, the work funded through the AHRQ Health IT Portfolio in 2011 continued to make important contributions to the field of health IT and further the evidence base on the impact of technology in health care. Research findings have helped to demonstrate where health IT improves quality, safety, and effectiveness. The rigorous scientific research funded through the Portfolio is also preparing the field for using future innovations and enhancing the evidence base for health IT by evaluating factors associated with successful implementation and utilization of health IT. This report provided a comprehensive overview of AHRQ's Health IT Portfolio, comprised of 169 projects active in 2011, including 129 grants and 40 contracts. The projects are diverse, representing the full range of technologies, care settings, and geography, including organizations in 36 States and the District of Columbia.

New projects continue to be funded to support research through the Portfolio's small (R03) and exploratory and developmental (R21) FOAs, as well as the general agency FOAs through which the Portfolio funds projects. In addition, in an effort to continually address gaps in research, two new health IT FOAs were published in April 2011 that fund research that will lead to improved design of health IT systems. The



Understanding Clinical Information Needs and Health Care Decision Making Processes in the Context of Health IT (R01) FOA will fund research aimed at elucidating the nature of cognition, task distribution, and work in health care delivery settings. The Understanding User Needs and Context to Inform Consumer Health IT Design (R01) FOA will fund projects that will help build a knowledge base about consumers' personal health information management needs and practices, and related design principles.

Many Portfolio projects were completed in 2011, including those remaining from the Enabling Quality Measurement (EQM) Through Health IT initiative, which is now closed. The findings from the EQM program have provided valuable evidence on developing safety and quality measures in ambulatory care settings, automating quality measurement, demonstrating the ability of electronic data systems to expand potential safety and quality measures, and demonstrating improved ability to export data for reporting performance on measures and improvement. EQM was one of four initiatives that were funded under the Ambulatory Safety and Quality (ASQ) Grant Program, which began in 2007. All projects from the other three initiatives – the Improving Quality through Clinician Use of Health IT (IQHIT) initiative, the Enabling Patient Centered Care (PCC) initiative, and the Improving Management of Individuals with Complex Health Care Needs (MCP) initiative – will conclude by 2012.

As described throughout the report, the Portfolio initiatives have been strengthened by the partnerships between Portfolio staff and Federal and private organizations. Collaborative efforts have resulted in co-sponsored conferences, funding for projects, and robust sharing of information.

This report summarizes project successes and shows how research has improved clinical decisionmaking tools for providers and provided new insights on how to engage patients with health IT. Collectively, the results from the Portfolio's projects can be translated to many health care settings to help improve health care outcomes. This report also highlights many of the ways the evidence stemming from the projects are disseminated including presentations, publications, and AHRQ sponsored newsletters, as well as social media such as Twitter.

The AHRQ Health IT Portfolio 2011 Annual Report is designed for health IT researchers, prospective grant or contract applicants, and

others interested in the challenges and successes of health IT implementation and use in terms of research and practical application. For additional detail regarding activities, progress, challenges, successes, and findings among the AHRQ-funded projects active in 2011, the project summaries available on the NRC Web site are an excellent resource. This report and the related summaries provide an overview of the characteristics of successful research projects and the principal investigators' abilities to adjust and persevere through the real-world challenges and setbacks encountered in health IT implementation, use, and evaluation.

V. Grant and Contract Project Summaries

Table 10: Grant Summaries (Ambulatory Safety and Quality)

Enabling Patient-Centered Care Through Health IT (PCC)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
Yes	Adams, William, MD	Conversational Information Technology for Better, Safer Pediatric Primary Care	HS07-007	48
Yes	Bove, Alfred, MD	Using a Telemedicine System to Promote Patient Care Among Underserved Individuals	HS07-007	50
Yes	Burns, Edith, MD	Enhancing Self Management of T2DM with an Automated Reminder and Feedback System	HS07-007	53
Yes	Chrischilles, Elizabeth, PhD	Personal Health Records and Elder Medication Use Quality	HS07-007	56
Yes	Chueh, Henry, MD	Ambulatory Care Compact to Organize Risk and Decisionmaking (ACCORD)	HS07-007	59
No	Hahn, Elizabeth, MA	Implementing a Low-Literacy, Multimedia Information Technology System to Enhance Patient-Centered Cancer Care	HS07-007	62
Yes	Jack, Brian, MD	Virtual Patient Advocate to Reduce Ambulatory Adverse Drug Events	HS07-007	65
Yes	Krist, Alexander, MD	An Interactive Preventive Health Record (IPHR) to Promote Patient-Centered Care	HS07-007	67
Yes	Samore, Matthew, MD	Patient-Centered Informatics System to Enhance Health Care in Rural Communities	HS07-007	69
Yes	Schillinger, Dean, MD	Harnessing Health Information Technology for Self-Management Support and Medication Activation in a Medicaid Health Plan	HS07-007	72
Yes	Stepnowsky, Carl, PhD	Enabling Sleep Apnea Patient-Centered Care Via an Internet Intervention	HS07-007	75
Yes	Tang, Paul, MD	Patient-Centered Online Disease Management Using a Personal Health Record System	HS07-007	77
Yes	Wagner, Peggy J., PhD	Using An Electronic Personal Health Record To Empower Patient With Hypertension	HS07-007	80
Yes	Wolf, Michael, PhD	Using Information Technology for Patient-Centered Communication and Decision Making about Medications	HS07-007	83
Improving Quality Through Clinician Use of Health IT (IQHIT)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
Yes	Baker, David, MD	Using Precision Performance Measurement to Conduct Focused Quality Improvement	HS07-006	85
No	Carrow, Grant, PhD	Enabling Electronic Prescribing and Enhanced Management of Controlled Medications	HS07-006	88
Yes	Fischer, Michael, MD	Impact of Office-Based E-Prescribing on Prescribing Processes and Outcomes	HS07-006	90
Yes	Forrest, Christopher, MD	Improving Otitis Media Care with Electronic Health Record-based Clinical Decision Support and Feedback	HS07-006	93

Yes	Fox, Karen, PhD	The Bettering Lives Utilizing Electronic Systems (BLUES) Project: Improving Diabetes Outcomes in Mississippi with Health Information Technology	HS07-006	95
Yes	Fricton, James, DDS, MS	eHealth Records to Improve Dental Care for Patients with Chronic Illnesses	HS07-006	97
Yes	Gardner, William, PhD	Pharmaceutical Safety Tracking (PhaST): Managing Medications for Patient Safety	HS07-006	100
Yes	Gorman, Paul, MD	RxSafe: Shared Medication Management and Decision Support for Rural Clinicians	HS07-006	102
Yes	Gurwitz, Jerry, MD	Improving Post-Hospital Medication Management of Older Adults with Health Information Technology	HS07-006	105
Yes	Johnson, Kevin B., MD, MS	STEPStools: Developing Web Services for Safe Pediatric Dosing	HS07-006	108
Yes	Kaushal, Rainu, MD	Electronic Prescribing and Electronic Transmission of Discharge Medication Lists	HS07-006	110
Yes	Kopal, Helene, MPH, MPA	Evaluation of a Computerized Clinical Decision Support System and EHR-linked Registry to Improve Management of Hypertension in Community-Based Health Centers	HS07-006	113
Yes	Lapane, Kate, PhD	Optimizing Medication History Value in Clinical Encounters with Elderly Patients	HS07-006	115
Yes	Lobach, David, MD, PhD, MS	Improving Quality through Decision Support for Evidence-Based Pharmacotherapy	HS07-006	118
Yes	Mehr, David, MD, MS	Using Health Information Technology to Improve Ambulatory Chronic Disease Care	HS07-006	120
Yes	Nebeker, Jonathan, MD	Veterans Administration Integrated Medication Manager	HS07-006	122
Yes	Pohl, Joanne, PhD	A Partnership for Clinician Electronic Health Record Use and Quality of Care	HS07-006	124
Yes	Schwarz, Eleanor, MD	Harnessing Health Information Technology to Prevent Medication-Induced Birth Defects	HS07-006	127
No	Simon, Steven, MD, MPH	Improving Laboratory Monitoring in Community Practices: A Randomized Trial	HS07-006	129
Yes	Trivedi, Madhukar, MD	Using Information Technology to Provide Measurement Based Care for Chronic Illness	HS07-006	132
Yes	Veline, James, MS, MA	Electronic Prescribing and Decision Support to Improve Rural Primary Care Quality	HS07-006	134

Improving Management of Individuals With Complex Healthcare Needs Through Health IT (MCP)

Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Baker, Wende M., MEd	Chronic Mental Health: Improving Outcomes through Ambulatory Care Coordination	HS08-002	137
No	Ciemins, Elizabeth, PhD	Evaluation of Effectiveness of an Health Information Technology-based Care Transition Information Transfer System	HS08-002	140
No	Dorr, David, MD, MS	Enhancing Complex Care through an Integrated Care Coordination Information System	HS08-002	143
No	Druss, Benjamin, MD, MPH	An Electronic Personal Health Record for Mental Health Consumers	HS08-002	145
No	Eisenstein, Eric, DBA	Improving Care Transitions for Complex Patients through Decision Support	HS08-002	147
No	Feldman, Penny, PhD	Improving Medication Management Practices and Care Transitions through Technology	HS08-002	149

No	Field, Terry, DSc	Using Health Information Technology to Improve Transitions of Complex Elderly Patients from Skilled Nursing Facilities (SNF) to Home	HS08-002	151
No	Friedman, Robert, MD	A Longitudinal Telephone and Multiple Disease Management System to Improve Ambulatory Care	HS08-002	153
No	Kahn, James, MD	Randomized Controlled Trial Embedded in an Electronic Health Record	HS08-002	156
No	Mertens, Ann, PhD	Improving Pediatric Cancer Survivorship Care Through SurvivorLink	HS08-002	158
No	Ritchie, Christine, MD, MSPH	E-Coaching: IVR-Enhanced Care Transition Support for Complex Patients	HS08-002	161
No	Singh, Hardeep, MD, MPH	Using Electronic Data to Improve Care of Patients with Known or Suspected Cancer	HS08-002	163
Enabling Quality Measurement Through Health IT (EQM)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
Yes	Berner, Eta, EdD	Closing the Feedback Loop to Improve Diagnostic Quality	HS07-002	165
Yes	Kaushal, Rainu, MD	Developing and Using Valid Clinical Quality Metrics for Health Information Technology with Health Information Exchange	HS07-002	167
Yes	Schneider, Eric, MD	Massachusetts Quality E-Measure Validation Study	HS07-002	169

Conversational Information Technology for Better, Safer Pediatric Primary Care

Principal Investigator:	Adams, William, M.D.
Organization:	Boston Medical Center
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017248
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,159,609

Summary: This project developed and evaluated an automated telephony system as part of prevention services delivered in an urban pediatric practice. The system gathers personal health data and counsels parents before scheduled visits, integrates the data with the physician's electronic health record (EHR), and offers personalized followup assessment and counseling. The internally developed interactive voice response (IVR) telephony system interfaces with the providers' EHR. The telephony system, called the Personal Health Partner (PHP), uses fully automated, interactive conversations (including synthetic speech and speech recognition) to gather health data and counsel parents before scheduled pediatric primary care visits. Parent-entered data are shared with the child's primary care provider (PCP) via the EHR, where data are reviewed and clinician decision support is provided.

The system was evaluated via a three-armed randomized controlled trial (PHP only, PHP assessment with counseling, or usual care groups) to determine the marginal effect of the PHP intervention on comprehensive preventive and medication management assessments during PCP visits; preventive and medication management counseling; healthier parental behaviors; and increased parental activation.

Specific Aims:

- Develop an automated telephony system that uses fully automated conversations to perform pre-visit pediatric primary care assessments, offer parental counseling (including appropriate medication use), and support clinician decisionmaking by incorporating the PHP child assessments into their EHR at the point-of-care. **(Achieved)**
- Conduct a randomized clinical trial to determine: 1) whether PHP assessment alone (no counseling) with EHR data exchange leads to higher quality preventive care and medication management; and 2) whether the addition of PHP counseling to PHP child assessments (before and after visits) is associated with increased quality and healthier parental behaviors. **(Achieved)**

2011 Activities: Recruitment for the trial, which began in April 2009, continued through February 2011. Children aged 4 months to 11 years who were primary care patients at Boston Medical Center were eligible for the study. All patients with a primary care visit between June 2009 and February 2011 were invited to participate via a mailed brochure that provided information about participation in the study and how to call the PHP system. A data exchange was developed and implemented for the PHP telephony system and the EHR, and the hospital's clinical data warehouse was set up to deliver appointment and medication data into the team's SQL server database. The content of the PHP system includes three

general areas: routine health care maintenance (RHCM), asthma symptom assessment, and medication safety. RHCM areas include: 1) general health supervision; 2) developmental screening; 3) diet and physical activity; 4) tuberculosis risk assessment; 5) smoking risk assessment; and 6) maternal depression screening. Participants were randomized into PHP only (n=74), PHP with counseling (n=290), and usual care (n=185). Once families began to use PHP successfully, providers were able to access this information in the EHR, and determine whether to accept the information to prepopulate the visit documentation.

Full implementation of the study protocol included printing and mailing of brochures using the PHP Manager (a PowerBuilder application), outbound calling, full implementation of the PHP patient-centered system, data exchange between the PHP system and the EHR, and completion of followup surveys.

Primary outcome measures were designed to assess whether patients received the appropriate care for prevention, treatment, and management. Parent- and provider-reported feasibility and acceptability were assessed via questionnaires developed by the study group and focused on usability, perceived value and effectiveness, and recommendation to others. Parent activation was assessed using a modified version of the 13-question Patient Activation Measure instrument. The instrument was modified to reflect activation from the point of view of a parent. Parental health literacy was assessed using the Rapid Estimate of Adult Literacy in Medicine, a valid test of word pronunciation that correlates with tests that evaluate a range of literacy skills.

As last self-reported in the AHRQ Research Reporting System, some project activities were on track while others were not, and project spending was on track. However, using a 1-year no-cost extension period, the team was able to extend the subject recruitment period and achieve all study aims. This project ended in August 2011.

Impact and Findings: PHP was able to identify and counsel in multiple areas. PHP parents were more likely to report discussing important issues such as depression and prescription medication use with their clinicians during visits. PHP parents were also more likely to report being better prepared for visits. Most PHP parents (89 percent) would recommend use of PHP to other parents. Use of a patient-centered IVR system such as PHP before routine health care maintenance visits can facilitate more comprehensive information at visits, identifying and counseling parents who have important issues, and better preparing parents and clinicians for visits. Systems like PHP have the potential to improve health-related behaviors, detect patient safety situations, and enhance patients' experience and engagement in primary care settings.

Target Population: Medically Underserved, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Using a Telemedicine System to Promote Patient Care Among Underserved Individuals

Principal Investigator:	Bove, Alfred, M.D.
Organization:	Temple University Clinical Research Center
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017202
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,198,371

Summary: Hypertension affects more than 65 million people in the United States and disproportionately affects African Americans. Untreated hypertension is associated with an increased risk for myocardial infarction, sudden death, stroke, and renal failure. Despite the importance of controlling hypertension and the availability of therapy, the clinical application of well-established guidelines has been sub-optimal and inadequate blood pressure (BP) control remains common.

A patient-provider partnership is needed to advance care for chronic conditions such as hypertension. Patients should be empowered through education, self-management, collaborative goal setting, and treatment planning. Chronic disease management and prevention present unique challenges for patient-centered care (PCC) because patients are followed only through episodic office visits. Chronic disease care requires innovative strategies to support the constructs of PCC in an efficient and cost-effective manner. Telemedicine has the capacity to empower the patient, strengthen the patient-provider relationship, and support a chronic care model of PCC in a realistic and sustainable manner.

Dr. Bove and his research team developed a patient-centered tool for managing hypertension within a primary care practice. The project built upon a pre-existing, internally developed telemedicine system that patients accessed via the Internet. The system provided patient education on hypertension and served as a tool for self-management, shared decisionmaking, and treatment planning. A cellular telephone interactive system accommodated subjects who did not have Internet access. The system incorporated hypertension treatment guideline education modules; self-reporting modules on topics such as blood pressure, weight, exercise, diet, and smoking; and automated reminders and feedback.

The research team observed patients' responses to Joint National Committee care measures aimed at lowering their BP to normal. Patients completed one of seven lessons per login, after which they received an automated reminder of the guidelines. An automatic report created by the database was sent to the primary care physician and the patient on a monthly basis. The report described, in both text and graphics, the patient's BP over that month, the medications the patient was on, and whether the patient was at his or her goal BP. Additionally, the report recommended a physician visit to those who were not within the goal. The primary outcome measure of this randomized, controlled trial was the proportion of subjects who achieved goal blood pressure. Secondary measures included the rate of self-monitoring, exercise measured as steps per day, weight, cardiovascular disease knowledge, number of patients meeting medication guidelines, and satisfaction with the practice.

Specific Aims:

- Enhance the current telemedicine system by incorporating guideline-based algorithms for hypertension treatment as well as automated reminders and feedback for both patients and health care providers. **(Achieved)**
- Determine the percentage of patients meeting guidelines for anti-hypertensive medication therapy. **(Achieved)**
- Empower inner-city African American patients to take a more active role in their health care through self-monitoring, education, reinforcement, and feedback through telemedicine. **(Achieved)**
- Measure telemedicine utilization. **(Achieved)**
- Examine the impact of the telemedicine system on medical knowledge, self-efficacy, and the quality of doctor-patient interaction as compared to controls. **(Achieved)**
- Compare blood pressure outcomes between control and telemedicine groups after 6 months of telemedicine risk management. **(Achieved)**

2011 Activities: Data collection was completed in early 2011. The remainder of the funding period was dedicated to data cleaning, coding, and analysis. Due to initial slow recruitment, the study team used a 1-year no-cost extension to allow additional time to meet the required sample size. As last self-reported in the AHRQ Research Reporting System, project progress and activities was mostly on track, and the project budget spending was roughly on target. This project was completed in August 2011.

Preliminary Impact and Findings: Project staff screened 536 subjects and enrolled 241 (45 percent) in the study. Of the total recruited subjects, 65 percent were female and 51 percent had access to the Internet. One-hundred-and-twenty participants (50 percent) were randomized into the telemedicine arm. The baseline data indicated that the demographics of the sample reflected the clinics' patient populations, and also indicated a need for improved cardiovascular risk management. The telemedicine group received a digital blood pressure meter and risk counseling. They were instructed to report BP, heart rate, weight, steps per day, and tobacco use twice weekly. All patients had baseline and 6-month followup visits.

During study implementation, the researchers found that the target population— inner city, African American patients— frequently had limited access to the Internet, which was the initial medium for the telemedicine intervention. The analysis also found a statistically significant relationship between income and home Internet access, where Internet access was the lowest for the low-income group. Early surveys, however, indicated that nearly all study participants had access to land or cellular phones. In response, the research team integrated an interactive voice response (IVR) component to their intervention to facilitate use by a broader population. IVR acted as an interface between patients and the telemedicine system and expanded access to the system.

An interim analysis indicated a statistically significant improvement from baseline in both intervention and control groups across systolic BP, diastolic BP, total cholesterol, low-density lipoproteins, high-density lipoproteins, triglycerides, and fasting blood glucose. Additionally, a significant decrease in systolic blood pressure was observed between the two study arms, indicating additional improvements in BP control over time in the telemedicine arm versus the control arm. In the final analysis, non-diabetic

subjects in the telemedicine group demonstrated a significant decrease in BP. Diabetic subjects showed similar reductions in systolic BP in the telemedicine and control groups. Adherence to BP medication was similar among the two groups. A secondary analysis found an increase in prescribed medications in the telemedicine group indicating that telemedicine also affected physician behavior. Overall, the study demonstrated that telemedicine was a useful tool for managing hypertension among asymptomatic non-diabetic subjects.

Target Population: Adults, Chronic Care*, Hypertension, Inner City*, Medically Underserved, Racial or Ethnic Minorities*: African Americans

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Enhancing Self-Management of Type 2 Diabetes With an Automated Reminder and Feedback System

Principal Investigator:	Burns, Edith, M.D.
Organization:	Medical College of Wisconsin Affiliated Hospitals
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care Through Health Information Technology (PCC)
Grant Number:	R18 HS 017276
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,166,243

Summary: This project tested the impact of an automated self-management monitor (ASMM) on glycemic control and self-management behaviors. The ASMM reminded patients to self-monitor their blood glucose (SMBG), prompted them to take medications, and provided education on the impact of lifestyle choices. The research team developed the ASMM, which is composed of a simple personal computer-glucometer interface, a docking unit, and specialized software. When the ASMM is docked, the software received data downloaded through the glucometer interface, interpreted the measures, matched them with individualized profiles for glycemic monitoring and control, and provided appropriate, individualized audio feedback. Feedback was based on a fuzzy logic algorithm that took into account current and previous values. Feedback also incorporated the Common Sense Model of Illness, a model that accounts for patients' perceptions of illness, including their comprehension of symptoms and coping mechanisms. The ASMM provided information on long-term control, as well as single glucose measures.

To demonstrate the effectiveness of the intervention, the project team recruited adults from community health centers and the Veteran's Health Administration (VHA) to participate in a randomized controlled trial. To participate subjects needed to have poorly controlled diabetes, defined as hemoglobin A1c (HbA1c) levels greater than 8 percent. Once participants were recruited, the project team contacted providers to obtain information about patients' glucose checking schedules and glycemic targets. A team member visited participants at home to collect baseline data and provide the glucometer and supplies necessary to perform SMBG. Three months later, at a second home visit, a study team member provided the participant with a standard set of educational materials, administered study surveys, determined any self-reported change in the medication regimen, and downloaded glucometer data. The patient was then randomized into either the intervention or usual care group. Intervention group participants received the ASMM and training on how to use the system. Additional home visits were conducted 9- and 15-months after enrollment. The primary outcome measure was a change in HbA1c levels. Secondary measures included self-management behaviors such as SMBG frequency, nutritional choices, physical activity, medication adherence, and patient use of diabetes educational materials.

Specific Aims:

- Demonstrate that use of the ASMM improves glycemic control in inadequately-controlled people with Type 2 diabetes. **(Achieved)**
- Demonstrate that this effect is sustained over longer-term followup. **(Achieved)**

- Identify self-management practices that improve in people using the ASMM. **(Achieved)**

2011 Activities: The randomized trial was completed in October 2010. In 2011, significant effort was dedicated to data cleaning, coding, and analysis. Statisticians reviewed the data files to merge and reconcile data recorded by the glucometers and data collected by the ASMM docking system. The analysis sought to identify differences in HbA1c levels over time and across intervention and usual care groups. Additionally, statisticians analyzed the differences between the data collected from the VHA and community-based care. The study team determined which patients engaged the intervention and identified differences in patterns of ASMM use. Additional analyses of behavior factors included cognitive function, age, income, health literacy, and beliefs about diabetes.

This project used a 1-year no-cost extension to complete the project. As last self-reported in the AHRQ Research Reporting System, project progress and activities were completely on track according to the revised timeline, and project budget spending was on target. This project was completed in August 2011.

Preliminary Impact and Findings: A total of 201 participants were randomized, with 102 individuals in the intervention group and 99 in the usual care group. Of these, 71 intervention participants and 89 usual care participants completed the 15-month study with analyzable ASMM data. The primary outcome analysis, change in HbA1c levels, demonstrated a significant decrease in HbA1c for all participants from baseline to 15 months ($p < .0001$). Overall, however, there was no significant difference in HbA1c between the intervention and usual care groups, or for VHA versus community participants. Descriptive analyses of medication changes over time show that community participants were more likely to remain on the same medicines and doses throughout the study than veteran participants (62.3 versus 52.1 percent); and less likely to have their insulin dose increased (18.9 versus 30.1 percent). Dr. Burns hypothesizes that the use of the VHA electronic medical record, which has built-in flags and reminders for diabetes management, led to more ongoing medication management resulting in fewer medication adjustments.

The following three patterns of ASMM use were evident in the intervention group: approximately 20 percent of participants appeared to not use the system at all, or requested that it be removed; 37 percent interacted with the system either on a short-term basis (1 to 2 months), or sporadically over the entire period (less than once every 2 weeks). The remaining 43 percent used the system on a regular basis. ASMM usage and docking patterns indicated that closer monitoring, or more frequent use of the ASMM, was associated with improved glucose control. Each additional docking of the ASMM within a 2-day period was associated with a decrease in glucose level of 1.4 mg/dl ($p < 0.0001$). This group of frequent users had an average drop of 0.5 points in HbA1c compared to 0.06 for the infrequent users ($p < 0.05$). Those regularly using the system during the final phase of the study (months 9 to 15), had an average decrease of 0.63 points in HbA1c versus 0.12 for infrequent users ($p < 0.008$). Patients who did not regularly dock the ASMM did not receive feedback from the system. The finding suggests that monitoring may result in improved control over time.

Demographic and behavioral factors that may have accounted for the decrease in HbA1c in all groups were also analyzed. Frequent system users trended toward being older (62 versus 59 years, $p = 0.06$), had longer duration of disease (15.5 versus 11.2 years, $p < 0.003$), and were more likely to be on insulin. At baseline they also had a greater fear of hypoglycemia, and scored higher on worry items related to diabetes self-management. Additionally, frequent users spent fewer hours in sedentary behavior at 15 months (3.8 versus 5.4 hours/day, $p < 0.008$). Dr. Burns hypothesizes that more-frequent users responded

to the feedback by making adjustments to their self-management behaviors, but the standard measures used may not have had enough sensitivity to detect significant changes in this relatively small group of individuals. The findings suggest the need to consider patient perceptions of illness when designing such interventions in order to achieve greater overall efficacy.

Target Population: Chronic Care*, Diabetes, Elderly*, Medically Underserved, Veterans

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Personal Health Records and Elder Medication Use Quality

Principal Investigator:	Chrischilles, Elizabeth, Ph.D.
Organization:	University of Iowa
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017034
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,199,999

Summary: The Medicare Modernization Act (MMA) of 2003 required health plans to provide medication therapy management (MTM) services to optimize therapeutic outcomes among high-risk patients with multiple chronic conditions taking multiple medications. Because the MMA did not dictate how health plans should deliver MTM, various delivery methods exist. Regardless of delivery method, a model of patient-centered MTM requires that the patient play a pivotal role in self-monitoring, self-evaluation, goal setting, and medication taking. This project evaluated the ability of a personal health record (PHR) to support and improve elderly patients' medication adherence, use, and management. The project team tested the hypotheses that: 1) a successfully maintained PHR reinforces self-efficacy for MTM; 2) an up-to-date PHR increases patient knowledge about medications; and 3) PHR-gained information allows patients to shift their beliefs about medication from concern to understanding.

Phase I of the project consisted of a series of patient, caregiver, and provider focus groups aimed at identifying patient and physician medication management practices, barriers to PHR use, and physician office workflow issues. Upon evaluating the feedback received during these sessions, the project team identified patients' and providers' wants and needs for the varied functionalities of PHR products, and developed a formal measure of the patients' role in maintaining their health. The team also conducted an environmental scan of commercially available PHR products to identify existing core PHR functions available to elderly patients.

Phases II and III of the project were hands-on trials of patients' interaction with a commercially available PHR. The team tested the PHR by measuring elderly patients' interaction with the technology and their resulting self-activation with respect to medication management. Phase II involved a usability study of the PHR via a human-computer interaction (HCI) laboratory assessment of elderly adults to identify the challenges patients face when using the PHR and the support needed to facilitate usage. After usability testing, it was determined that the commercially available PHR was not well-suited to medication management activities. A new PHR using participatory design methodologies was developed. Subsequently, in Phase III, a randomized controlled trial was conducted comparing older adults using the new PHR with those not using the PHR to assess outcomes, patient-physician communication, and other technology utilization measures.

Specific Aims:

- Develop measures of patient MTM behaviors and patient self-efficacy for MTM. **(Achieved)**
- Compare the patient-reported MTM behaviors, medication adherence, patient- and physician-

centric medication quality indicators, patient self-efficacy for MTM, and patient beliefs about medication among patients randomized to a current, representative PHR system versus patients randomized to usual care. **(Achieved)**

- Investigate the usability of the PHR system in an HCI interaction laboratory compared with alternative prototypes developed through participatory design with older adults of varying ability levels. Associate PHR performance with measures of cognitive, motor, and perceptual ability. **(Achieved)**

2011 Activities: Due to delays in the adaptation of the PHR user interface and tracking, the project team used a 1-year no-cost extension that allowed for continued work on this project in 2011. Baseline data was examined by generating frequency distributions and comparing study groups across select characteristics to assess any differences. Survey responses were coded to examine changes over time. Medication data collected at baseline were cleaned and coded using an online interface developed to facilitate this work, and a preliminary assessment of data was completed. The team examined the relationship between multiple chronic conditions and the use of a medication list, and the association of keeping a medication list and patient-provider interaction.

As last self-reported in the AHRQ Research Reporting System, project progress was mostly on track and project budget spending was on target. This project was completed in August 2011.

Impact and Findings: A total of 1,163 people were randomized into the trial; after attrition, 1,075 were included in the analyses. The mean age of the study participants was 72 years; 56.8 percent of participants were women. At baseline, the control group was more likely to have changed the strength or dose of a prescription medication in the past 3 months. At followup, the intervention group was less likely to have started an over-the-counter medication in the previous 3 months than was the control group (8.9 percent versus 13.2 percent), and to be taking two or more nonsteroidal anti-inflammatory drugs (14.1 percent versus 19.4 percent).

Thirty-eight-point-eight percent of the subjects never attempted to log on to the system during the study period. Of those who did, 5.7 percent did not complete the login process, and 4.1 percent completed login but performed no activity with the PHR. More than 40 percent of the intervention group entered at least one medication into the PHR, and the system displayed at least one medication warning message for nearly one-third of them. The most frequent PHR-generated medication warnings were for nonsteroidal anti-inflammatory drugs, angiotensin converting enzyme inhibitors, and acetaminophen.

After adjusting for baseline differences, PHR high-users reported significantly higher over-the-counter medication use at followup compared to PHR low-users and non-users. Significantly more high-users reported keeping a current medication list than did low- and non-users. High-users were also significantly more likely to report having had a side effect in the past 3 months, but they also were more likely to report that they know how to recognize side effects. Upon adjusting for pre-existing differences in the medical problems and number of medications, there was no difference between high-users and low- and non-users in number of medication management problems at followup. Physical health declined from baseline to followup in all user groups. There were no differences observed in health care utilization. Users did not differ in either physical or mental health.

Target Population: Elderly*, Medicare

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the exchange of electronic health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Ambulatory Care Compact to Organize Risk and Decisionmaking

Principal Investigator:	Chueh, Henry, M.D.
Organization:	Massachusetts General Hospital
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care Through Health Information Technology (PCC)
Grant Number:	R18 HS 017190
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$923,783

Summary: Increased emphasis on care guidelines and efforts that focus on a relatively narrow set of quality measures to improve quality of care have transformed the practice of medicine in ways that are both good and bad for patients and clinicians. Standardized care algorithms attempt to promote uniform compliance with evidence-based care. Underutilization of standardized care algorithms may be due to their inability to accommodate individual patient and clinician preferences and values. With greater access to health information via the Internet and other media, patients are increasingly involved in the medical decisionmaking process. At the same time, advances in health information technology (IT) have ushered in electronic health records (EHRs), increasing capacity to identify and track patient populations within a health system. These advances facilitate the design of new models of primary care delivery that employ system-level health IT tools to promote patient and clinician partnerships.

This project involved designing, developing, implementing, and evaluating a comprehensive, practical, and innovative model of care delivery to support the process of shared decisionmaking. The system, titled Ambulatory Care Compact to Organize Risk and Decisionmaking (ACCORD), allowed patients to collaborate with clinicians to establish, monitor, and track shared clinical care plans. ACCORD interfaced with the Massachusetts General Primary Care Practice-Based Research Network’s preexisting internally developed EHR system.

The project team developed ACCORD to help providers and patients manage followup activities for primary care visits. The team selected the following domains for ACCORD maintenance: preventive health screenings, abnormal findings followup, and medication monitoring. ACCORD enabled patient-specific care plan development to reduce miscommunication between providers and patients by presenting care plans as explicit “compacts” or agreements between provider and patient, and provided explanatory information about the risks of not adhering to the plans.

The project activities were organized into three stages. In Stage 1, the team designed, built, and tested the system to develop a usable method of compact authoring and tracking. In Stage 2, they tested the tool to determine if providers and patients were comfortable creating compacts and if the tool was effective in this capacity. In Stage 3, the team conducted a randomized controlled trial (RCT) in a primary care practice and an institution-wide cohort study in another primary care practice to examine system adoption and process measures. The RCT examined differences in outcomes, such as preventive screening test completion, chronic disease management, patient engagement, patient knowledge, patient-provider communication, patient and clinician satisfaction, and various system-utilization metrics.

Specific Aims:

- Design a model for patient-centered primary care that facilitates patient-clinician partnerships that results in documented followup care plans that can be tracked reliably to reduce the risk of care plans being lost to followup in busy primary care networks. **(Achieved)**
- Develop a health IT architecture and software (i.e., ACCORD) to support the developed patient-centered care-delivery model. **(Achieved)**
- Implement and evaluate ACCORD in an RCT within the Massachusetts General Primary Care Practice-Based Research Network. **(Ongoing)**

2011 Activities: The research team completed design of the RCT. Revisions were made to accommodate recruitment delays and the new scenario for initiating ACCORD from patient lists in Oncall Answers result sets, the local EHR. The study design for the RCT focused on three ACCORDs expected to be appropriate for a relatively high frequency-of-use study population. The population eligible within the study time frame was identified by query, and both the control and intervention groups were targeted for additional enrollment support. Intervention group providers were trained to use ACCORD in both the episodic, one-problem-at-a-time scenarios initially conceived, and the cohort-based scenario in which providers proposed the same range of ACCORD options to a list of patients matching specific indications.

The 1-year no-cost extension provided the necessary time to continue research activities, which were slowed due to delays in the development of the patient portal. Activities will continue past the end of the project period to complete the final aim. The project will utilize resources beyond AHRQ funding to complete this work. As last reported in the AHRQ Research Reporting System, project progress was mostly on track and project budget spending was on target. The project period ended in August 2011.

Impact and Findings: Focus group findings centered on: 1) patient and provider perception of decisionmaking; 2) strategies patients and providers use to improve shared decisionmaking; 3) desired characteristics of the ACCORD system from the patient and provider perspectives; and 4) perceived benefits and concerns of the ACCORD system. Desired characteristics reported by patients included integration with specialists, assistance with support for topic-specific communication, and access to vetted information authored in- and outside Massachusetts General Hospital. Desired characteristics reported by providers included integration with clinical information systems and workflow and support for post-visit review that includes automated detection of events suitable for ACCORD, such as detecting that a chest X-ray report contains mention of a “solitary pulmonary nodule.” Patients and providers alike wanted the system to facilitate the preparation of topics for upcoming visits.

Patients’ reports on the usefulness of the reminders varied, since many already use a variety of personal systems. Providers cited “always on” reminders to patients and adjustable reminders to providers as a desired characteristic of the ACCORD system. Patients believed that ACCORD had the potential to provide more direct access to the information patients need, reduce barriers to communicating with their physician, and clarify care plans. Providers felt that a mechanism to expose patients to appropriate topics and educational materials prior to a visit would allow patients to participate more effectively in decisionmaking. Chronic disease management, preventive health care, medication management, and followup of non-urgent but potentially concerning findings were all areas reported as amenable to shared decisionmaking.

Participants noted concerns about the security of health information accessible via the Internet, the difficulty of locating relevant and up-to-date consumer health information, the potential limited utility of the system for patients with low computer literacy, and the need for integration of ACCORDs with care plans created by patients with other care providers not participating in ACCORD. Both providers and patients expressed concerns about the time it would take for providers and patients to use the ACCORD system during visits.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Implementing a Low-Literacy, Multimedia Information Technology System to Enhance Patient-Centered Cancer Care

Principal Investigator:	Hahn, Elizabeth, M.A.
Organization:	Northwestern University
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care Through Health Information Technology (PCC)
Grant Number:	R18 HS 017300
Project Period:	September 2007 – September 2012
AHRQ Funding Amount:	\$1,198,839

Summary: Information about cancer, if delivered in a user-friendly way, can reach peoples with limited literacy skills. This research team, led by Elizabeth Hahn, hypothesizes that promoting patient understanding of disease and treatment through innovative information delivery methods will lead to better communication; treatment adherence; and outcomes including patient satisfaction with health care, cancer-related knowledge, self-efficacy, treatment, and health-related quality of life (HRQL).

This project modified a widely-used talking touchscreen multimedia information and assessment system for patients being treated for breast and colorectal cancer to be more accessible for patients across the spectrum of literacy skills. The CancerHelp® Talking Touchscreen (TT), developed by the CancerHelp Institute and investigators on this grant, is available at participating clinics during office hours via a kiosk at the site. The software provides patient education on diagnoses, treatment, support, side effects, prevention, and screening. It contains easy access to cancer information from the National Cancer Institute, user statistics, and customizable features. Strategies to enhance the ease of understanding of the material and navigating through the program will be implemented. For example, the amount of text on each screen will be shortened; patients will have the option to choose between text-based or audio presentation of education materials, communication tools, and assessment questions; and videos will be developed for certain modules.

The intervention is being evaluated through a randomized controlled trial (RCT) with a targeted enrollment of 200 patients with breast or colorectal cancer at three ambulatory cancer care centers. Patients in both the intervention group and control group will use the TT to complete surveys on knowledge, satisfaction, HRQL, and other study measures, as many as three times during treatment and once afterwards. Both groups will receive diagnosis- and treatment-specific brochures; however, only patients randomized to the intervention arm will have access to the intervention-adapted software. The Behavioral Model for Vulnerable Populations, which assesses patient characteristics, resources, needs, health behaviors, and health outcomes, will also be used to assess study outcomes.

During regular visits to cancer care centers for treatment, participants interact with the adapted CancerHelp® TT that enables patients to print information and generate a visit-specific checklist of their top priorities to discuss with their providers. At the conclusion of their in-clinic cancer treatments, participants in the intervention arm also receive a post-treatment cancer survivorship care plan, modeled on templates from the Institute of Medicine (IOM). The survivorship care plan summarizes the cancer

treatments they have received and provides appropriate aftercare recommendations, including detailed contact information for future appointments. Participants' oncologists review the care plan with the participants and instruct the participants to provide a copy to their primary care physicians (PCPs). This survivorship care planning is designed to minimize the interruptions in care that can occur when patients complete their cancer treatments.

Specific Aims:

- Test whether a low-literacy-friendly multimedia information and assessment information technology system used in daily clinical practice improves patient outcomes during treatment in 200 recently-diagnosed breast and colorectal cancer patients based on the primary endpoints: satisfaction with health care communication, knowledge of cancer and treatment, self-efficacy, adherence to recommended treatment, and HRQL. **(Ongoing)**
- Evaluate the relationships between patient characteristics, resources, needs, health behaviors, and health outcomes using the Behavioral Model for Vulnerable Populations. **(Ongoing)**
- Test whether use of the multimedia information technology system improves adherence to recommended post-treatment surveillance care and HRQL during the early post-treatment surveillance period (3 months after treatment). **(Upcoming)**

2011 Activities: The research team continued to recruit and enroll patients into the RCT. The team held regular onsite meetings with the directors of the three participating sites to review procedures for identifying and enrolling patients. These meetings facilitate communication, organization of patient data, and identification of the physician responsible for presenting the survivorship plan to the patient. The project has now recruited 129 of 200 patients. Due to lower-than-expected patient volume, it may not be possible to reach the recruitment goal. However, because the power calculations were based on a modest improvement in the outcome, Ms. Hahn expects that there will be enough statistical power to detect a strong impact, even with lower enrollment.

Survivorship plans continue to be developed for intervention arm patients. Clinician compliance with developing and distributing the plans continues to be a challenge, as clinicians do not always have enough time. As a result, research assistants complete as much of the plan as possible and the plans are given to study participants who are encouraged to share them with their PCPs for discussion of ongoing care.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track with the revised timeline and project budget spending is roughly on target. The project team is using two 1-year no-cost extensions to provide extra time to for study recruitment and data analysis.

Preliminary Impact and Findings: Thirteen patients were enrolled in field testing that was completed toward the end of 2009. Patient feedback was largely positive and was used to improve the software.

Ms. Hahn reports that this study has been extremely informative regarding the feasibility, acceptability, and implementation of survivorship care plans. While the IOM recommends that every cancer patient receives a survivorship plan, providers often do not have the time to develop the plan. Ms. Hahn reports that an automated mechanism for developing survivorship care plans could facilitate the process.

Target Population: Adults, Cancer: Breast and Colorectal, Low Literacy, Low SES/Low Income*, Medically Underserved, Safety Net

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Virtual Patient Advocate to Reduce Ambulatory Adverse Drug Events

Principal Investigator:	Jack, Brian, M.D.
Organization:	Boston Medical Center
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care (PCC) Through Health Information Technology
Grant Number:	R18 HS 017196
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,180,772

Summary: The transition period between hospitalization and the first post-hospitalization ambulatory visit has a high risk for medical errors. The objective of this project was to expand the use of an animated conversational agent to assist patients during this transition. In prior AHRQ-funded studies (UC1 HS 014289 and U18 HS 015905), the research team developed a paper-based tool, the After Hospital Care Plan (AHCP), to deliver the Re-Engineered Hospital Discharge, a set of recommended activities to be performed at the time of discharge. Subsequently, in order to make the AHCP electronically available, Dr. Jack and his team developed the Virtual Patient Advocate (VPA), a computerized animated character named “Louise” that emulates the face-to-face conversational behavior of an empathic provider.

Louise offers health education, advice on monitoring and self-care, and assessment of medication dosing and adherence. To meet the needs of an ambulatory environment, the team modified the content, logic, layout, workstation, AHCP, and training manual. The team also developed links between the VPA system, Boston Medical Center’s electronic medical record (EMR), and the ambulatory providers’ information technology systems. They conducted a series of qualitative evaluations with potential users and clinicians. Once the beta version of the VPA was prepared, the team pre-tested the system with potential users and clinicians, made modifications pursuant to findings, and conducted a randomized controlled trial with subjects who were at high risk of adverse drug events.

The participants in the randomized trial were instructed to: 1) check in with the Louise via computer following discharge from the hospital and on a regular basis before the first post-hospital visit; 2) bring to the first post-discharge visit the result of the online interactions, which is a list of items to discuss with the clinician; and 3) meet with the Louise after the ambulatory visit for instructions on any medication regimen changes made during the office visit. The team evaluated the intervention by comparing process outcomes (i.e., enrollment, adherence, attrition, fidelity, therapeutic alliance, and patient activation) and clinical outcomes (i.e., patient and provider satisfaction, patient knowledge of self-care and medications, adverse events, and pharmacist interventions) of those using the VPA to outcomes for a usual-care group. Concurrently, the team pursued dissemination of the VPA by introducing the system to other interested health care organizations.

Specific Aims:

- Program the VPA, a computer-based, interactive, animated character, to offer patients with limited health literacy or health education advice on self-care and medication use during the transition from hospital to ambulatory care. **(Achieved)**

- Design and implement an ambulatory care plan using the VPA to educate the patient and respond to questions. **(Achieved)**
- Evaluate the intervention in the ambulatory setting. **(Achieved)**
- Build a robust dissemination program that will introduce this system into a health care system that is a member of a national test bed. **(Achieved)**

2011 Activities: The focus of 2011 was data entry, cleaning, and analysis. A 1-year no-cost extension was used to complete technology development and patient recruitment. The project timeline was therefore adjusted to allow time for data analysis in 2011. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. This project was completed in August 2011.

Preliminary Impact and Findings: A total of 47 patients enrolled in the study. Sixty-two percent of enrolled patients were female, 64 percent were between the ages of 40-69, 66 percent were black, and 81 percent were single, divorced, separated, or widowed. Of enrolled patients 70 percent screened with high health literacy. Twenty-three enrollees were randomized to the control group and 24 to the intervention group. The study cohort was followed from discharge until their first appointment with their primary care provider, a time of approximately 2 weeks. Of the 47 randomized patients, four logged into the system. The four patients logged in an average of eight times each, to generate a total of 31 alerts. Fifty-five percent of the alerts related to a possible side effect. Other alerts included inability to pick up medications, intentional non-adherence, and appointment rescheduling.

The project team hypothesizes that patients may have used the system only if they were concerned about their health. None of the four users were re-hospitalized or had an emergency room visit. Dr. Jack reported that the study was limited by participants' lack of access to the Internet in their homes, which was crucial for the success of this project. Dr. Jack would like to conduct a fully-powered randomized controlled study following this pilot study.

Target Population: Adults, Low-SES/Low Income*, Medically Underserved, Racial or Ethnic Minorities*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

An Interactive Preventive Health Record to Promote Patient-Centered Care

Principal Investigator:	Krist, Alexander, M.D.
Organization:	Virginia Commonwealth University
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017046
Project Period:	September 2007 – February 2011
AHRQ Funding Amount:	\$1,198,677

Summary: While there is clear evidence supporting the health benefits of preventive care, Americans receive only 50 percent of indicated preventive services. A number of patient, clinician, and health care system barriers contribute to this gap in the delivery of quality preventive care.

The objectives of this project were to design, develop, implement, and evaluate whether linking MyPreventiveCare, an interactive preventive health record (IPHR), to an electronic medical record (EMR) would increase the number of patients who receive recommended screening tests, immunizations, and counseling. MyPreventiveCare provides tailored recommendations, links to educational resources and decision aids, and patient and clinician reminders. The PHR gave the patient a link to preventive elements of his or her EMR, a health-risk assessment, an individualized list of recommended preventive services based on risk stratification, education resources, and reminders. Reminders included messages encouraging healthy behaviors and recommended services, alerts informing patients when they become eligible for retesting or new services, and requests encouraging patients to update their profiles. MyPreventiveCare provided the clinician with a summary of the patient’s risk factor information, which could be used to update the clinician’s EMR.

The study involved eight primary care practices in the Virginia Ambulatory Care Outcomes Research Network. All of the practices used the Allscripts Touchworks® EMR. A randomly selected sample of 5,500 of the practices’ 228,000 patients, stratified by age and gender, received a request from their clinicians to use MyPreventiveCare or receive “usual” preventive care. The project team used this randomized controlled trial to examine the effects of MyPreventiveCare on clinical preventive services, shared decisionmaking, and patient-physician communication. This involved the analysis of data in the EMR, utilization data from MyPreventiveCare, and data collected from patient and provider surveys.

Specific Aims:

- Evaluate whether an invitation from a patient’s primary care clinician to use MyPreventiveCare increases use of the system. **(Achieved)**
- Evaluate whether an invitation from a patient’s primary care clinician to use MyPreventiveCare increases delivery of age- and gender-appropriate clinical preventive services. **(Achieved)**
- Evaluate whether an invitation from a patient’s primary care clinician to use MyPreventiveCare increases shared decisionmaking for preventive services. **(Achieved)**
- Evaluate whether an invitation from a patient’s primary care clinician to use MyPreventiveCare improves clinician-patient communication about preventive needs. **(Achieved)**

2011 Activities: The study team used a 6-month no-cost extension to complete final project activities. Data collection, analysis, and manuscript development were the primary focus during this period. All grant activities were completed by the end of the project period.

Impact and Findings: At 4 months, the proportion of indicated preventive services that were received by eligible patients did not increase significantly among patients in the intervention group compared to the control group. Not all patients assigned to the IPHR arm used it, but statistically significant changes were observed in those who did. The proportion of indicated preventive services received increased by 5.6 percent among users, whereas non-users experienced an insignificant increase.

Over 16 months, the proportion of eligible preventive services that were up-to-date declined in both the control group and the non-user subset of the intervention population but increased among IPHR users. The proportion of patients who were up-to-date with all 18 preventive services did not change significantly over the 4 months or differ significantly between groups, in either the intention-to-treat analysis or the comparison of users and non-users. At 16 months, however, the proportion of patients who were up-to-date with all preventive services was higher among intervention patients (including both users and non-users) than among controls, but the net increase among intervention patients was demonstrably greater among users than non-users.

The primary care practices received a summary from the IPHR on all patients who used the system. The summary was transmitted electronically to the EMR task list for the patient's self-identified primary provider. A chart review and content analysis of these summaries revealed that only 2.2 percent of users were up-to-date for all preventive and chronic care services covered by the IPHR. Among users, 49 and 56 percent were due for screening tests and vaccinations, respectively; 91 and 55 percent needed health behavior counseling and preventive medications, respectively; and 35 percent had inadequate control of chronic conditions. These alerts led clinicians to update the EMR records of 59 percent of patients to fill in missing information that patients had entered into the IPHR. With few exceptions, clinicians accepted the patient's reported updates and changes as accurate. Additionally, after receiving the summaries from the IPHR, the study practices contacted 27 percent of patients to schedule a wellness visit, 17 percent to schedule a chronic care visit, and 19 percent to deliver a specific service (e.g., mail a referral for a mammogram or colonoscopy, arrange a nurse visit for an immunization).

Focus groups with patients revealed that trust and functionality were the two major themes that influenced whether they would use a health Web site and the value they obtained from doing so. Trust included whether they believed that: 1) information on the Web site was accurate; and 2) security and confidentiality of their personal information would be protected. Functionality included whether the patient expected a health Web site would be useful, the anticipated benefits of using a Web site, and the potential challenges of using a Web site. The degree to which trust and functionality (and their subthemes) mattered to patients was dependent on the relationship of their clinician to the Web site. For example, several participants noted that all information on the Internet is vulnerable, but they seemed willing "to take a leap of faith" with their personal health information and use a Web site if it had the approval of their clinician.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Patient-Centered Informatics System to Enhance Health Care in Rural Communities

Principal Investigator:	Samore, Matthew, M.D.
Organization:	University of Utah
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017308
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$1,199,999

Summary: This was a demonstration project to evaluate whether integrating the functions of an electronic medical record (EMR), personal health record (PHR), and a communication system leads to more patient-centered care in rural communities in Utah. This system, the Unified Health Resource (UHR), provided disease information and decision-support tools for patient self-management of acute and chronic diseases, supported the reconciliation of medication lists, and enabled exchange of information between clinicians and patients through a series of structured, bidirectional communication channels.

The EMR and PHR function independently from each other. The UHR software developer, CaduRx, designed an interface that allows each side to view and import changes to reflect updates made by the other. Patients were able view items such as physician notes, diagnoses, and diagnostic test results in their PHR. Physicians, granted access by their patients, were able to view and import the patient's information, including new prescriptions, symptoms, or diseases from the PHR to the EMR. In addition, there were several types of structured e-visits that patients could use to communicate with clinics and clinicians. Patients could request medication refills online as well as input results of home monitoring tests, such as blood sugar levels and blood pressure measurements, into their PHR. Through extensive usability testing, the project team ensured that the vocabulary used in the PHR was understood by patients, clinically significant to providers, linkable to International Classification of Diseases and clinical modification codes, and able to be coded for clinics' record keeping and billing purposes.

To assess the effect of the UHR on patient-centered care, the team conducted a prospective cohort study among adult patients at one of the clinics that use the UHR. Of the patients recruited, 25 percent did not have a chronic disease diagnosis and 75 percent had one or more of the following chronic illnesses: diabetes mellitus, hypertension, chronic heart disease, and chronic obstructive pulmonary disease. Measures of patient activation, involvement in decision-making, self-management behaviors, medication management, and preventive practices were taken at baseline and follow-up. The team analyzed data abstracted from the UHR and conducted a manual review of the patients' medical records to compare the provider assessment of patient disease management to the patient's self report. A formative evaluation of the UHR assessed and improved usability, usefulness, and adoption.

Specific Aims:

- Recruit two rural primary care clinics that use UHR and two primary care clinics that use an alternative, non-UHR EMR system to participate in a 3-year research demonstration project.
(Achieved)

- Apply formative evaluation methods to assess and improve usability, usefulness, and adoption of the UHR personal health system by patients. **(Achieved)**
- Enroll patients from the four participating rural clinics into a prospective cohort study to assess the impact of the UHR personal health system on patient-centered care. **(Achieved)**
- Examine patterns of use of the UHR personal health system. **(Achieved)**
- Increase awareness, confidence, and skills to use PHRs and Internet health resources among rural community residents, leveraging local libraries and health departments. **(Achieved)**

2011 Activities: The focus in 2011 was on data cleaning, analysis, and dissemination. The following analyses were conducted: 1) measurement and validation of patient activation; 2) a qualitative assessment of patients' perceptions of and experiences with the UHR; 3) usage patterns of the UHR; and 4) development of models to understand the relationship between patient characteristics and patient involvement in health care decisionmaking.

Due to additional time required for study recruitment, a 1-year no cost-extension was used, allowing the research team to complete outcome evaluation and disseminate project results. As last self-reported in the AHRQ Research Reporting System, project progress was mostly on track and project budget spending was on target. The project was completed in September 2011.

Preliminary Impact and Findings: A total of 811 participants, 62 percent female, 64 percent over the age of 45, and 7 percent non-white, participated in a survey of patient activation. Participants indicated a high level of satisfaction with their care and positive relationships with their physician. On the patient activation measures, 96 percent of respondents indicate that they are responsible for managing their own health; 98 percent take an active role in their most important health factors; and 93 percent take actions to minimize or prevent symptoms.

An analysis of patient usage and UHR perceptions identified the components of the system that were ranked most favorably and may have ultimately driven patient adoption of the system. An analysis of 6,700 UHR sessions indicated that medication refill, reconciliation functions, drug safety, and adverse event components were the most frequently accessed and most favorably reviewed. The mean number of actions per session was 15 (range 1-679). For short sessions, defined as 10 actions or less, the primary task was scheduling appointments and reviewing visit notes. For long sessions, defined as more than 20 actions, the predominant actions were completion of health history items, searching for information about medications, medication reconciliation, and health maintenance activities.

In terms of UHR adoption, the research team determined that clinical staff engagement and clinic fit-to-workflow were critical. Clinic staff, including providers, needed to understand the UHR's utility as well as its potential to increase office efficiency and improve patient outcomes. In order for clinic staff to promote the UHR to patients, it was necessary for the staff to recognize the relative advantages of patient use of the UHR for the clinic. As for patient adoption, the team discovered that patients were very interested in the idea of a PHR linked to their health care provider and clinic records. The challenge was making patients aware of how the tool was integrated with the clinic and how to use it correctly.

Target Population: Adults, Chronic Care*, Chronic Obstructive Pulmonary Disease, Diabetes, Heart Disease, Hypertension, Rural Health*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Harnessing Health Information Technology for Self-Management Support and Medication Activation in a Medicaid Health Plan

Principal Investigator:	Schillinger, Dean, M.D.
Organization:	University of California, San Francisco
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care Through Health Information Technology (PCC)
Grant Number:	R18 HS 017261
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,130,769

Summary: The Self-Management Automated Real Time Telephone Support (SMART-Steps) Program enhanced an automated telephone self-management (ATSM) support system to provide ethnically-diverse, publicly-insured adults and older adults who have diabetes with surveillance, education, and additional telephone care management guided by questions on patient behavior. This work built on a previously-funded Agency for Healthcare Research and Quality (R21 HS 014864) project by implementing modifications to adapt the program for sustained use by users with low literacy. Through a quasi-experimental study design, the project team examined the effects of the intervention among SMART-Steps Program participants from the San Francisco Health Plan (SFHP), a Medicaid plan. Enrolled patients were randomized to the ATSM-only group (SMART-Steps ONLY), the ATSM-plus group (SMART-Steps PLUS), or the usual care comparison group that subsequently received ATSM-only or ATSM-plus services. In the SMART-Steps ONLY model, patients responded to a rotating set of questions on self-care, psychosocial aspects of care, and receipt of preventive services. Patients with an answer that was “out of range” on an item received an immediate automated health education message. Patients with an answer “significantly out of range” received the automated message plus a followup person-to-person call from a SFHP care manager. In addition to those services, the SMART-Steps PLUS model had supplementary phone communications from the ATSM care manager to the patient triggered by data derived from pharmacy claims and a diabetes registry. These calls provided further education about medication adherence based on clinical criteria developed by a clinical advisory board.

Dr. Dean Schillinger and his research team conducted patient surveys to analyze outcomes such as perspectives on the structure of their care and the interpersonal processes of care. To analyze patient safety, the team explored characteristics of adverse events: triggers, frequencies, their nature, preventability or ability to be ameliorated, and clinician awareness. To analyze effects of the intervention on relevant metabolic and clinical processes and outcome measures, the team used electronically-available clinical and administrative data.

Specific Aims:

- Measure the effects of a Medicaid health plan-directed ATSM on patient-centered outcomes among ethnically-diverse health plan enrollees with diabetes. **(Achieved)**
- Explore whether combining ATSM with an additional patient-directed health information technology innovation—a medication activation communication strategy triggered by pharmacy

claims data—yields differential effects on patient-centered outcomes compared to ATSM alone. **(Achieved)**

- Quantify and characterize patient safety events triggered and/or identified through active surveillance among ATSM participants. **(Achieved)**
- Measure differences in the frequency and nature of patient safety events among participants receiving ATSM-only versus ATSM-plus medication activation. **(Achieved)**
- Explore the effects of ATSM interventions on Healthcare Effectiveness Data and Information Set (HEDIS)-relevant metabolic and clinical process and outcome measures when compared to usual care. **(Achieved)**
- Explore whether ATSM-plus medication activation is superior to ATSM-only with respect to HEDIS-relevant metabolic and clinical process and outcome measures. **(Achieved)**

2011 Activities: The SFHP continued to enroll health plan members in the SMART-Steps Program in 2011. A total of 910 members were assessed for eligibility. Of those, a total of 362 enrolled in SMART-Steps. Members were excluded if they did not meet the inclusion criteria (220), could not be contacted (168), or declined to participate (160). The enrollees included 186 Cantonese, 107 English, and 69 Spanish speakers. A total of 278 baseline surveys were completed (78 percent), with 252 (91 percent) of first-time followup completed. Furthermore, 114 of 128 eligible participants (89 percent) completed their second interview.

The research team worked closely with SFHP outreach and care management staff in a consultative and supportive role. Support included: monitoring quality assurance of care manager efforts, facilitating communication between SFHP staff and community provider sites, ensuring accurate interpretation of daily and weekly data reports, and promoting secure monthly data exchange between the Community Health Network diabetes registry and the SFHP staff to allow SFHP to identify potentially-eligible SFHP members. The team also monitored the fidelity of the participant randomization process, the wait-listing procedures intrinsic to the quasi-experimental design, and the care management protocols.

The research team also focused on data collection and data cleaning. Data analysis included: 1) a comparison of patient-centered outcomes and quality of life among patients randomized to the intervention and control arms; 2) a comparison of ATSM to ATSM-plus for participants transitioning into the intervention group; 3) an analysis of clinical outcomes for hemoglobin A1C and low density lipoprotein cholesterol; and 4) an analysis of safety events.

A 1-year no-cost extension was used to extend study recruitment. The project timeline was therefore adjusted to allow time for data analysis in 2011. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. The project was completed in August 2011.

Preliminary Impact and Findings: SFPH members who enrolled in SMART-Steps were significantly more likely to be younger, female, Hispanic/Latino, non-English speaking, and less likely to be white/Caucasian. There were no significant differences in hemoglobin A1c, systolic blood pressure, diastolic blood pressure, or low density lipoprotein between those who enrolled and those who declined to participate in the study. Further data analysis will continue beyond the funding period.

Target Population: Adults, Diabetes, Elderly*, Low Literacy, Low SES/Low Income*, Medicaid, Medically Underserved, Medicare, Racial or Ethnic Minorities*, Safety Net, Uninsured

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Enabling Sleep Apnea Patient-Centered Care via an Internet Intervention

Principal Investigator:	Stepnowsky, Carl, Ph.D.
Organization:	Veterans Medical Research Foundation
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017246
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,155,062

Summary: Continuous positive airway pressure (CPAP) is the therapy providers use most often to treat Obstructive sleep apnea (OSA) syndrome. Poor adherence to CPAP therapy is well-documented. This project developed an integrated remote monitoring device and Internet-based portal for patients with OSA who are prescribed CPAP treatment. The project evaluated the intervention's effect on patients' experience of care, CPAP adherence, and OSA outcomes.

OSA syndrome is a common condition that is treated with a CPAP flow generator, a machine that blows air at a physician-prescribed pressure into a facemask or nasal pillow. The Restraxx Data Center (RDC), composed of the Restraxx wireless module, affixes to and transmits data from the CPAP flow generator, and the server/database, which houses the data and restricts access to authorized health care professionals.

The objectively-measured adherence data from the RDC was transmitted to both patient and provider and used as the central outcome measure to evaluate the intervention. The provider portal contained information including adherence, volume of air leak, and number of apneas and hypopneas per hour. With this information, the provider continuously monitored the patient's progress and made ongoing decisions to support the patient and/or alter his or her treatment plan.

The team organized the data provided by the RDC into user-friendly pieces of information that are provided to the patient through the Internet Positive Airway Pressure (i-PAP) patient portal. The portal included a learning center with information on sleep apnea and the CPAP device, charts that provided objectively-measured adherence and efficacy data, self-tracked changes in weight, sleepiness, physical activity, and other user-defined factors over time. The learning center also contained self-assessment materials (including research surveys) an interactive troubleshooting guide, and cleaning instructions.

The research team conducted a randomized controlled clinical trial to evaluate the effects of the interactive portion of the CPAP treatment. Both the usual care group and the i-PAP patients were provided with CPAP devices and education materials on OSA. The trial evaluated the effect of having the Internet-based portal to facilitate the flow of information and communication between providers and patients in addition to the CPAP device. The team evaluated whether and how the i-PAP intervention affected OSA-related outcomes, CPAP adherence, patient-centeredness of care, patient assessment of and satisfaction with care, and patient activation. In addition, the team examined indicators such as use of the Web site and the frequency and nature of clinical contacts to understand the reasons behind any effects.

Specific Aims:

- Examine the effect of the i-PAP intervention compared to usual care on the patient's experience of the quality of patient-centered, collaborative care. **(Achieved)**
- Examine the effect of the i-PAP Internet intervention compared to usual care on the level of CPAP adherence. **(Achieved)**
- Examine the effect of i-PAP compared to usual care on OSA outcomes. **(Achieved)**
- Perform a basic cost analysis of the i-PAP intervention compared to usual care, applying a micro-cost methodology of measuring the quantity of inputs used in the production of care and the unit cost of each. **(Achieved)**

2011 Activities: Data were aggregated and transferred from Excel to SPSS. Scoring and data value checking were completed; scoring algorithms for questionnaires had been completed previously. Data analysis and manuscript development continued during this period.

Due to delays stemming from following up with the project subjects, the project team used a 12-month no-cost extension. The team used this time to finish data analysis. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. The project was completed in August 2011.

Impact and Findings: The main finding of the study was that the i-CPAP intervention resulted in higher adherence relative to the usual care group. This difference was almost 1 hour per night. However, the difference of 1 hour per night did not appear to make a difference in the measured OSA symptoms between the interventional groups.

The key advantage of the i-CPAP intervention was the availability of resources important to the patient, including the learning center, the troubleshooting guide, and the data tracking. In the development of the i-CPAP intervention, the project was not able to execute certain functions due to privacy and confidentiality concerns related to local policies. These functions included: 1) setting up an e-mail contact system between patient and provider; 2) setting up a forum or bulletin board for enrolled participants; and 3) allowing for greater tracking possibilities. Health-related behavior change is in large part susceptible to several key behavioral change techniques, including goal-setting, self-monitoring, peer support, and increased self-efficacy. It may be that in omitting peer support, the intervention lost a potentially efficacious component. In a previous study by this research team, a group self-management program with peer support as one of its core components had a slightly larger effect. The key advantage of the i-CPAP intervention is its ability to provide OSA patients with the information they need when they need it, which is consistent with a patient-centered, collaborative care approach. The i-CPAP intervention provides the core of future interventional efforts using this technology.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Patient-Centered Online Disease Management Using a Personal Health Record System

Principal Investigator:	Tang, Paul, M.D.
Organization:	Palo Alto Medical Foundation
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care (PCC) through Health Information Technology
Grant Number:	R18 HS 017179
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,158,401

Summary: Diabetes is a major, growing, and costly chronic disease in the United States; yet, implementation of recommended diabetes care is suboptimal and inconsistent for a sizable proportion of affected Americans. In an effort to reduce the treatment and adherence gaps in diabetes care, this study evaluated an online disease management system that actively supports a partnership between the patient and his or her multidisciplinary care management (CM) team. This program provided a platform for online disease management (ODM) for many different chronic conditions in a range of ambulatory care settings.

The CM team included a nurse diabetes care coordinator, a clinical pharmacist, a nutritionist, and the patient’s physician(s). The ODM system was integrated with Epic Systems’ EpicCare, a comprehensive, electronic health record (EHR) system that includes a personal health record (PHR) and secure patient-clinician messaging capabilities. Patients of the Palo Alto Medical Foundation (PAMF) have access to an integrated PHR called PAMFOnline, which is a customized version of Epic Systems’ MyChart PHR. PAMFOnline provides patients with: 1) a health summary from their EHR (diagnoses, medications, allergies, laboratory test results with physician annotations, immunizations, and a health maintenance schedule); 2) physician-endorsed information resources about health topics; 3) the ability to request a prescription renewal or appointment; 4) a list of pending appointments and laboratory orders; and 5) private notes by patients which are not visible to the clinical staff. In addition, patients can communicate electronically with their health care team.

Using a specially-designed wireless adaptor attached to their glucometer, patients uploaded their glucometer readings to their PHR. Once logged onto PAMFOnline, they viewed the information graphically and correlated their glucose trends with other information about their health behavior (e.g., diet, exercise, medication use). Utilizing the shared action plan developed specifically for each individual, the patient worked with the CM team, primarily via online communication, to adjust medications or make further lifestyle changes. Custom-tailored “nuggets” of patient education and advice were “dispensed” to a patient based on his or her specific clinical situation (e.g., responding to uploaded glucose readings, nutrition logs, test results, or patient questions). These “nuggets” included personalized text, videos, graphs, or hyperlinks on topics such as hypoglycemia, controlling food portions, and exercise. The project team also provided a diabetes summary report that consolidated all of a patient’s relevant diabetes information. An important topic of the report correlated the patient’s specific action plan with their risk of major complications (e.g., stroke, kidney failure, heart attack, blindness) from diabetes.

The project team evaluated the ODM program for diabetes in a randomized, controlled trial (RCT) of patients at PAMF who had inadequately-controlled type 2 diabetes, defined as hemoglobin A1c (HbA1c) greater than 7.5 percent, and did not have severe complications. The primary hypothesis under evaluation was that patients in the intervention arm would have lower HbA1c at 12 months post-randomization than those receiving usual medical care. Secondary hypotheses were that the intervention would be associated with: 1) improved self-management practices such as medication adherence, home monitoring of glucose and blood pressure, healthy diet, and regular exercise; 2) improved biologic measurements such as blood pressure and lipids; 3) better processes of care such as frequency of monitoring tests, lower cardiovascular risk, enhanced patient experience, and satisfaction with care; and 4) improved patient psychosocial well-being. These measures were assessed in both groups by laboratory testing, EHR data extraction, and an online questionnaire at baseline, 6 months, and 12 months post-randomization.

Specific Aims:

- Refine the Personalized Health Care Program platform with a particular focus on enhancing the customization capability of the ODM system and ensuring a seamless incorporation of ODM into the workflow of clinicians on the CM team and with the self-management process of patients. **(Achieved)**
- Evaluate the ODM program for diabetes relative to usual medical care, in a two-arm RCT. **(Achieved)**
- Disseminate results of the RCT in the scientific literature and deploy the Customized, Continuous Care Management program in PAMF and other ambulatory care settings for use with diabetes and other chronic conditions. **(Achieved)**

2011 Activities: The primary focus during this period was data collection and analysis. A 1-year no-cost extension provided adequate time for research assistants to continue to meet with patients passing their 6-month and 12-month anniversary, and conduct the appropriate data collection activities. As last self-reported in the AHRQ Research Reporting System, project progress was completely on track and project budget spending was on target. The project was completed in August 2011.

Impact and Findings: Over 61,000 home-monitored glucose readings were uploaded by participants in the intervention group over the course of the study. Patients maintained ongoing care management relationships with the care team, communicating consistently throughout the study. A total of 2,625 MyHealthOnline secure messages and 151 phone calls were initiated by patients over the 12-month intervention. The total time spent by the nurse care manager and registered dietician during the intervention ranged from 1 to 18 hours per patient, with an average of 6 hours per patient, including all remote contact, and individual and group sessions.

Compared to usual care, participants in the intervention group had significantly better control of their diabetes as measured by HbA1c at 6 months, but the difference was not statistically significant at 12 months. In a secondary analysis, significantly more patients in the intervention group improved control (i.e., >0.5% improvement in HbA1c) of their diabetes than usual care at both 6 months and 12 months. A majority of patients had an increase or a significant increase in confidence in their ability to manage their diabetes, make lifestyle changes, and maintain lifestyle changes. In addition, the majority of patients specified that, as a result of being enrolled in the program, they 1) took their medications more regularly; 2) made healthy food choices more often; 3) exercised more; 4) paid more attention to their diets; 5) completed laboratory tests more regularly; 6) tested glucose at home more often; and 7) kept up with preventative actions more routinely.

Target Population: Adults, Chronic Care*, Diabetes

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Using an Electronic Personal Health Record to Empower Patients With Hypertension

Principal Investigator:	Wagner, Peggy J., Ph.D.
Organization:	Georgia Health Sciences University
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017234
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,181,369

Summary: Patient- and family-centered care (PFCC) represents a new paradigm for health care delivery, in which patients and their families take an active role in their health care management and decisionmaking. Evidence shows that PFCC improves outcomes by reducing medication errors, increasing compliance, and improving disease management. However, implementation of patient-centered care in the ambulatory setting remains elusive for most clinical practices in the United States. An electronic personal health record (ePHR) can help overcome barriers to adoption of PFCC by maximizing patient-clinical collaboration, self-management, and related health outcomes.

The project examined the feasibility, acceptability, and impact of an ePHR for patients with hypertension. The project used Cerner Health's ePHR, My HealthLink through the Medical College of Georgia (MCG). To foster personal wellness and chronic condition management, My HealthLink allowed consumers to log entries into their ePHR, track progress against their customized care plan, complete health assessments, communicate securely with providers, access health education content, and check for interactions between medications.

The project team worked with Cerner to customize My HealthLink by incorporating the experiences, perspectives, and insights of patients and their families in the design of the ePHR. Patients from the MCG Medical Center were enrolled and researchers conducted two iterative pilot beta tests to evaluate the modified ePHR. Each beta test session had participants use the ePHR for 2 weeks. Subsequent acceptability interviews were conducted and analyzed to identify common themes. Once the modifications suggested by the beta test participants were fully incorporated, a clustered randomized controlled trial was conducted to compare a group using My HealthLink with those receiving usual care. The effectiveness of My HealthLink was evaluated through questionnaires and biological measurements, including patient activation and perception of care; biological markers, specifically blood pressure, body mass index, and lipid levels; collaborative patient-physician communication; congruence of medication treatment with guidelines; and frequency-of-use of medical services. The team also evaluated, via surveys and in-depth interviews, physician and staff perceptions of the ePHR and attitudes towards patient- and family-centered practices.

Specific Aims:

- Improve the application of PFCC elements in an existing ePHR system. **(Achieved)**
- Implement and test the effectiveness of the revised ePHR (My HealthLink) with patients who are

being treated for hypertension by a team of physicians, mid-level practitioners, nurse clinicians, and support staff in two ambulatory settings. **(Achieved)**

- Monitor the shift in provider and support staff awareness and incorporation of PFCC concepts as a result of the implementation of the ePHR. **(Achieved)**

2011 Activities: Data collection and analysis were the major focus during the remainder of the project's no-cost extension period. Post-trial interviews with participating physicians and staff were completed. A total of 13 physicians completed the post-study structured interview and patient empowerment scale (PES). Four focus groups involving a total of 14 staff and nurses were conducted. Two members of the team focused on identification of themes within all post-trial interviews and they completed analysis of the post-trial PES data. The results from this analysis were prepared for dissemination and the project staff developed and submitted a manuscript that addressed differences among qualitative themes of providers and patients, pre-ePHR use and post-ePHR changes in patients on the PES scale, and PES differences between providers and patients. All these differences affect perceptions of patient empowerment as a result of ePHR use. Information from the chart audits was analyzed for use in the final data comparisons and dissemination of results.

All patient-physician recordings were transcribed. Qualitative analysis was conducted on patient-physician transcriptions and email communications. The 2005, 2008, and 2010 PFCC Institutional Survey results were analyzed and prepared for dissemination.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were on track and project spending was on track. The project was completed in August 2011 at the completion of the 12-month no-cost extension.

Impact and Findings: The project staff observed no impact of the ePHR on blood pressure, patient activation, patient perceived quality, or medical utilization in the intention-to-treat analysis. Sub-analysis of intervention patients who self-identified as active ePHR users showed a 5.25-point reduction in diastolic blood pressure. Younger age, greater computer skills, and more positive provider communication ratings were associated with increased frequency of ePHR use. Institutional culture improved over time and was highly correlated with increasing use of patient advisors throughout the health care system. Simply providing an ePHR has limited impact on patient blood pressure, empowerment, satisfaction with care, or use of health services.

Inclusion of patients and patient and family advisors in the development of an existing ePHR did improve certain elements of acceptability, but ePHR use remained low overall with those enrolled in the ePHR arm of the randomized trial. Overall, minimal differences between patients in the intervention group and those in the control group were found. Weight, body mass index, waist circumference, high-density lipid levels, PES total empowerment scores, consumer assessment of health care providers and systems (CAHPS) global doctor rating, composite doctor communication rating, and CAHPS composite office staff rating were significant but none of the raw effect sizes were of sufficient magnitude to imply clinically meaningful differences between groups.

Both patients and providers reflected positively on the ePHR in terms of patient empowerment, pre-visit preparation, recognizing medical errors, adherence, and sense of personal control. Providers expressed concern about patient worry, confusion, and the potential for offense by documentation comments. Results

from the PFCC Institutional Survey support an increase in positive attitudes and awareness toward PFCC practices from 2005 to 2008 to 2010. These results corresponded to increasing PFCC implementation throughout the health care system, though this cannot be attributed to the ePHR project alone since it is only a minor part of the system.

Target Population: Adults, Chronic Care*, Hypertension

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Using Information Technology for Patient-Centered Communication and Decisionmaking about Medications

Principal Investigator:	Wolf, Michael, Ph.D.
Organization:	Northwestern University
Mechanism:	RFA: HS07-007: Ambulatory Safety and Quality Program: Enabling Patient-Centered Care through Health Information Technology (PCC)
Grant Number:	R18 HS 017220
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,199,997

Summary: Medication errors are a major source of patient injury, hospitalization, and death. Medication management in primary care is extremely complicated because of the continually expanding array of available therapies, fragmentation of care, proliferation of information sources, and numerous obstacles experienced by patients (e.g., cost). This study integrated interventions that target patients, providers, and the overall practice system in an effort to improve the medication management process.

The overarching objective of this multicomponent intervention was to develop a protocol to reconcile medications through the phases of the patient-provider clinical encounter. The project provided patient education materials and medication lists automatically extracted from Epic Systems' electronic medical record (EMR), EpicCare to adults enrolled in the project. In advance of their physician visit at a multispecialty primary care center, patients received the materials, reviewed the medication information contained within the system, and indicated if there were any discrepancies or if they had any related questions or concerns. The nurse reviewed the patient-provided information and placed the output into the rooming sheet for the physician. The system encouraged physicians to engage in shared decisionmaking by including prompts to elicit questions and concerns and ways to tailor treatment plans to match patients' needs and abilities. The physician clarified any issues with the patient and updated the patient's medication list in the EMR. When new medication was prescribed, the system generated a plain-language medication information sheet for the patient. The information sheet was automatically generated through project-developed "dot phrases" (system macros that automatically fill in descriptive text prompted by key words) in the EMR, an enhancement made to the existing functionality of the EpicCare EMR.

The clinic was organized into four areas (pods) with separate nursing staff and physicians and the clustered, controlled clinical trial was randomized at this "pod" level. Through post-visit interviews and data extracted from the EMR, the project assessed post-visit discrepancies in the medication list, the patient's functional understanding of his/her medication regimen, questions on adherence and safety, and a series of process measures to verify that the intervention was translatable to other organizations.

Specific Aims:

- Develop and test a multimedia program (which was revised to an educational print piece) to help patients understand the importance of both giving and receiving accurate information about medications (pre-visit patient intervention). **(Achieved)**
- Use the EMR to encourage patient-centered medication management. **(Achieved)**

- Work with the practice-based research network to disseminate and track the use of effective interventions, and create pathways for facilitating national distribution to other practices. **(Achieved)**

2011 Activities: The 12-month no-cost extension enabled data collection activities to be completed and the team to focus on obtaining data reports and cleaning data. There were some difficulties obtaining the final target recruitment numbers. At one site, aspects of the intervention were turned off when the EMR was rebooted; however, there was no effect on the overall progress and data quality. As last self-reported in the AHRQ Research Reporting System, project progress and activities were on track in some respects but not others and project budget spending was on target. All project activities were completed when the project ended in August 2011.

Impact and Findings: The researchers on this project found gains in reducing discrepancies related to prescription omissions in the medication list. Fewer gains were achieved in reducing discrepancies related to removing medicines no longer being taken and adding omitted non-prescription regimens patients report taking daily. Key informant interviews alluded to physician barriers not addressed by the intervention; for example, desire not to remove another physician's order, lack of perceived salience of non-prescription medicines, lack of time for more complicated regimens, and failure to change the EMR at the time of the visit. Findings to date have substantial value in understanding how best to change existing practices to ensure medication reconciliation, education, and counseling when new medication is prescribed.

Several-hundred medication sheets were developed through this project. These are tangible products that have been widely accepted by physicians as assisting in improving and managing patient care.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of transitions across care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Using Precision Performance Measurement to Conduct Focused Quality Improvement

Principal Investigator:	Baker, David, M.D.
Organization:	Northwestern University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017163
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,199,415

Summary: Measures that utilize data collected for administrative use, such as billing data, may have inaccuracies at the individual patient level. A quality measure may be recorded as not having been met because a patient was incorrectly considered to be eligible or refused the intervention, or because the appropriate data were not captured. As a result of these limitations, clinicians may reach their quality benchmark targets but still be reported as having fallen short. A health care system that delivers near 100 percent high-quality care for chronic disease care and prevention must rely upon precise measurement methods. Quality measurement needs to be embedded within electronic health record (EHR) systems and become dynamic, accurate, and detailed to support the highest level of care possible for all patients.

This project created systems that allowed clinicians to capture reasons for not providing care as part of point-of-care clinical decision support reminder systems to improve data quality and seamlessly link data to practice-level quality improvement programs and point-of-care interventions. The project used previously-developed quality measurement programs that examine EHR data to measure quality of care for coronary artery disease, heart failure, diabetes, hypertension, and preventive services. This study began at a large academic internal medicine practice and was then implemented in four community practices that use a common EHR.

Exception codes for 18 national quality measures were introduced into the EHR. These measures have been developed by organizations such as the Physicians' Consortium for Performance Improvement at the American Medical Association, or adapted from measures of the National Committee for Quality Assurance. The statistical significance of changes was assessed with time-series analysis. In addition, physicians were repeatedly surveyed on their attitudes toward the interventions. Outcomes of the quality improvement activities were monitored along with the costs of the intervention.

The project consisted of two phases. Phase 1 interventions included point-of-care reminders, linked order sets, point-of-care tools within reminders for documenting exceptions (i.e., patient refusals, inability to afford medications, and contraindications or adverse reactions to recommended interventions), quarterly performance reports, and monthly lists for each physician of their patients who were not prescribed "essential" medications. In addition, there was a patient-focused intervention: if a patient refused a recommended procedure and the physician documented this, the patient was sent information about the benefits of the intervention (e.g., medication or preventive service) and contacted to see if s/he wanted

to change his/her decision and receive the intervention. In addition to the interventions described above, Phase 2 included printing a list of unsatisfied quality measures for physicians to review before entering the examination room.

Specific Aims:

- Integrate simple, standard ways for clinicians to document patient reasons or medical reasons for why quality measures are not met and assess the use of these exception codes, the impact of exception reporting on measured levels of quality, and the impact of using these codes on physician satisfaction and self-reported efficiency. **(Achieved)**
- Use the exception codes (patient reasons and medical reasons) that clinicians enter to target three forms of quality improvement, including: 1) peer review of all medical reasons for not adhering to guidelines followed by academic detailing if a clinician enters an unjustified reason for not following guidelines; 2) counseling for patients whose physician enters an exclusion code stating that the patient cannot afford a needed medication, to determine ways of overcoming barriers; and 3) educational outreach to all patients who refuse recommended interventions, including mailing of plain-language health education materials or DVDs. **(Achieved)**
- Provide clinicians with highly accurate information on patients' quality deficits immediately prior to their visit as part of routine workflow, and assess whether this intervention increases provision of recommended therapies and tests and documentation of exclusion codes. **(Achieved)**

2011 Activities: The research team finished collecting and analyzing data by the end of the 1-year no-cost extension. As last self-reported in the AHRQ Research Reporting System, project progress and activities were completely on track and the project budget was somewhat underspent, approximately 5 to 20 percent. The project was completed in August 2011.

Impact and Findings: For Phase 1, during the year before the start of the intervention, performance improved significantly for eight measures, did not change for six, and declined for one. Temporal trends could not be calculated for cervical cancer screening because undated exceptions were recorded during the pre-intervention period. During the year after the start of the intervention, performance improved significantly for 14 measures, improved non-significantly for another (hemoglobin A1c control), and declined for one. During the intervention year, the rate of improvement in performance was significantly greater for nine measures and of borderline significance for another. Another four measures improved during the post-intervention period, but the rates of improvement were similar to the pre-intervention period. The rate of improvement in performance for osteoporosis screening was lower during the intervention year than the pre-intervention year. The absolute rate of screening mammography declined, which was attributed to a shortage of trained radiologists and prolonged waiting times at the institution. The improvements in performance during the intervention year were due to a combination of more patients satisfying the measures and documentation of exceptions.

For Phase 2, the addition of paper reminders to the interventions in Phase 1 did not have a marginal benefit overall, and it did not improve performance for the physicians with the worst performance at the end of Phase 1. Performance improved significantly for eight of the 16 measures during Phase 2. Performance had improved significantly during Phase 1 for all of these eight measures. Performance of screening mammography declined significantly during Phase 2; this was already declining in Phase 1, as described

above. Performance decreased for two other measures during Phase 2: 1) prescription of anticoagulants for patients with atrial fibrillation and heart failure; and 2) nephropathy screening or management for patients with diabetes. Both of these had previously shown an improvement in performance during Phase 1. Performance did not change during Phase 2 for prescribing antiplatelet drugs for patients with coronary artery disease; performance had increased during Phase 1 and remained stable at a very high level (approximately 95 percent). Glycemic control (hemoglobin A1c < 8 mg/dl) did not change throughout the study.

Target Population: Adults, Chronic Care*, Diabetes, Heart Disease, Hypertension

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management..

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Enabling Electronic Prescribing and Enhanced Management of Controlled Medications

Principal Investigator:	Carrow, Grant, Ph.D.
Organization:	Massachusetts Department of Public Health
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017157
Project Period:	September 2007 – May 2012
AHRQ Funding Amount:	\$1,199,794

Summary: Expansion of electronic prescribing (e-prescribing) to cover federally-controlled substances (e.g., narcotics, stimulants, sedatives) is expected to increase access to needed medications and reduce risks of prescription fraud. The goal of this project is to foster the safe and productive adoption of e-prescribing of federally-controlled substances through the design, implementation, and evaluation of a safe, secure, and efficient system for electronic transmission of controlled substance prescriptions by ambulatory care clinicians at the point-of-care. It will help inform the U.S. Drug Enforcement Administration (DEA) as it implements the recently-promulgated Interim Final Rule (75 FR 16236) governing the electronic prescribing of controlled substances (EPCS).

The project team, led by Dr. Carrow and the Massachusetts Department of Public Health (MDPH) Drug Control Program, is partnering with health information technology solutions providers DrFirst, Inc. and Emdeon to design, implement, and field-test a system for e-prescribing controlled substances in a contained ambulatory care environment. Concurrently, the project is developing and testing a data interface between the e-prescribing system and the Massachusetts Prescription Monitoring Program (MA PMP) to monitor nonmedical use and abuse of federally-controlled medications while supporting enhanced patient-clinician communication, medication access, and safety of patients with chronic medical conditions.

Specific Aims:

- Develop, implement, and verify a system of safe and secure electronic transmission of prescriptions for federally-controlled substances in an ambulatory care setting. **(Achieved)**
- Develop and test the interfacing of this e-prescribing system with the Massachusetts PMP to monitor prescription fraud and nonmedical use of controlled medications. **(Achieved)**
- Conduct systems process and outcomes evaluations of the improvements to patient care, risk reduction, patient and clinician benefits, patient safety, and information privacy and confidentiality that are expected as a result of this system. **(Ongoing)**
- Develop and implement a plan for dissemination of findings. **(Ongoing)**

2011 Activities: Activity continued to expand the EPCS system among the study's participating prescribers who had received cryptotokens (hard tokens) and transmitted at least one EPCS. In addition, the project team:

- Worked with the prescribing and pharmacy application vendors about complying with the DEA's Interim Final Rule (IFR) on EPCS;
- Addressed operational issues associated with the initial version of EPCS software developed by DrFirst,

the prescribing application partner in the project;

- Facilitated discussions with pharmacy application vendors on securing data for the information technology security expert and the MA PMP;
- Distributed followup surveys to the second group of providers who received cryptokeys; and
- Monitored the American Institute of Certified Public Accountants' efforts to develop guidelines for CPA firms that are conducting third party audits of prescribing and pharmacy applications.

The rigorous requirements of the IFR (promulgated 2.5 years after the start of this project), the complexity of the EPCS system, and interdependency of the various software applications contributed to various challenges to achieving compliance with the IFR. The prescribing memorandum of understanding was signed and received by MDPH in April 2011. The DEA required the project team to make a good-faith effort to come into compliance with the IFR and the team worked with the prescribing and pharmacy applications to encourage that outcome. Due to the additional time required to meet the IFR mandate, the project is using an 8-month no-cost extension to complete the project. As last self-reported in the AHRQ Research Reporting System, the project is now completely on track and budget spending is on target.

The project team developed manuscripts, posters, and presentations to disseminate information about the project and broaden the understanding of EPCS and the IFR. These included a poster session titled "Electronic Prescribing of Controlled Medications: Results of a Demonstration Project," presented at AHRQ's 2011 Annual Conference in September, and an article titled "[Prescribers' Expectations and Barriers to Electronic Prescribing of Controlled Substances](#)," published in the *Journal of the American Medical Informatics Association* in September. As the project approaches its conclusion in 2012, the primary focus will be on the development of the final report and on the identification of findings from implementing and using the EPCS system. Providers who do not have the opportunity to extend their use of the current system to electronically prescribe controlled substances will receive communication from the project team congratulating and thanking them for their participation in the study and the contributions that their efforts made to the industry. The communication will advise them of the project's conclusion and share information on lessons learned. The project will continue to monitor developments in other areas of the country as limited rollouts of EPCS emerge and will identify opportunities to gather additional empirical information on the current model.

Preliminary Impact and Findings: Findings that have been made available throughout the course of the project include: 1) the results of the prescribing provider survey conducted in the first quarter of 2009, which examined provider use of e-prescribing and perceptions of EPCS in their daily practice of medicine; 2) the requirements of the DEA IFR on EPCS; and 3) the challenges, both technical and operational, of introducing EPCS into medical practices and the pharmacy community within the DEA's parameters. Analysis of additional findings is underway and will be available in the final report.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

Impact of Office-Based E-Prescribing on Prescribing Processes and Outcomes

Principal Investigator:	Fischer, Michael, M.D.
Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017151
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,199,007

Summary: Suboptimal prescribing practices in outpatient settings can result in errors and excessive costs. Electronic prescribing (e-prescribing), which allows prescribers to write prescriptions electronically, is thought to be an important tool for meeting this challenge. The Medicare Modernization Act of 2003 set goals for the adoption of e-prescribing across the country, and private coalitions have used financial incentives to encourage its adoption. Effective e-prescribing systems must have utility for prescribers and must be integrated into routine medical practice workflow. If e-prescribing is to improve quality and safety, it must have valid and usable decision support capabilities and be available at the point of care.

The primary aim of this study was to evaluate the implementation of an e-prescribing system in ambulatory settings. The vendor ZixCorp's PocketScript system is currently used in a large number of practices in Massachusetts, New Jersey, Pennsylvania, New York, North Carolina, California, and Louisiana, providing a large study population with diverse practice types (e.g., pediatric, adult primary care, family practice, and specialty offices), locations (urban, suburban, and rural), and sizes (from single-physician practices to groups of more than 20 providers). This study evaluated the use of alerts and drug history, and the impact of e-prescribing on workflow, patient safety, and patient adherence. The project staff partnered with the developers of the office-based e-prescribing system, and with multiple insurance companies and public programs that provided claims data.

The project was conducted in three phases. The first phase used data from the e-prescribing system to evaluate physician responses to decision-support interventions and alerts. In the second phase, the project team brought information technology experts and experienced survey researchers together to develop a qualitative study demonstrating the impact of e-prescribing on prescribing processes and outpatient workflow. The study included a large-scale survey to develop a detailed understanding of how e-prescribing can be integrated into medical practice. The third phase of the project drew on decades of project team experience in studying large medical databases to evaluate prescribing decisions and clinical outcomes when e-prescribing is initiated. The project linked patients' e-prescriptions with pharmacy claims and generated a comprehensive dataset to evaluate the true clinical impact of e-prescribing.

Specific Aims:

- Measure physician use of two safety-related e-prescribing functions: safety alerts and dispensed drug history. **(Achieved)**

- Measure the effect of e-prescribing on processes of prescribing for physicians to assess characteristics of successful and productive adoption. **(Achieved)**
- Extend and expand ongoing research to assess whether the adoption of e-prescribing is associated with improved clinical outcomes for patients. **(Achieved)**

2011 Activities: The project collaborated with ZixCorps, an e-prescribing vendor, and two large insurance providers: Tufts Health Plan and Blue Cross Blue Shield of Massachusetts. Their data provided insights to the research questions. The data were prepared, and the analytic files and linkages across data sets were cleaned. A 1-year no-cost extension was used to complete all of the analyses for the project. The study team identified medications that generate alerts more frequently and the rates at which different medications are cancelled versus prescribed despite safety warnings. They characterized the rates at which physicians use e-prescribing and defined other metrics of how sophisticated is their use of the system. The team identified physician characteristics that may predict use of the system and developed models to evaluate these associations.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were on track, and project budget spending was on target. Difficulties obtaining data from the collaborating organizations necessitated the 1-year no-cost extension. The project activities were completed when the project ended in August 2011.

Impact and Findings: Qualitative analyses identified seven themes, ranging from positive to negative, that affect how physicians adopt new technologies. Survey results indicated that physicians using e-prescribing systems that were part of an integrated electronic health record were more likely to use advanced e-prescribing features than were physicians using stand-alone e-prescribing systems. Quantitative analyses showed that physicians used e-prescribing systems more frequently, and they used more of the features over time. Of the 1,947 eligible respondents, 1,011 completed the survey, a response rate of 52 percent. Response rates by survey strata were almost equivalent: 51 percent for physicians in the regular-use stratum and 53 percent in the low-use stratum. Sixty percent of respondents reported having an integrated e-prescribing system; the rest had a stand-alone system. Those with integrated systems were more likely than those with stand-alone systems to be primary care physicians, to practice in larger groups and in a hospital or medical center, and to have practiced for fewer years. They were also more likely to be regular users of e-prescribing.

Ninety-seven percent of respondents reported that they were able to send prescriptions electronically. Eighty-seven percent had e-prescribing systems that included drug warnings or contraindications and the ability to manage refill authorizations.

Physicians with integrated systems were significantly more likely than those with stand-alone systems to report writing prescriptions electronically most or all of the time. At least half of physicians said that their use of e-prescribing made it easier for them to take care of prescription refills themselves, have staff take care of refills, batch process refills, write an initial prescription for a new patient, and prescribe within a patient's formulary. The majority (88 percent) of physicians were satisfied with their e-prescribing system. Overall, physicians reported that their use of e-prescribing had a positive effect on the safety of their prescribing practices. Sixty-eight percent of physicians reported that their system made it easier to reconcile a patient's medication list, and 57 percent reported a reduction in the number of calls the practice received from pharmacies about prescribing errors.

Use of the e-prescribing system increased with duration of experience with the system. While physicians who had been using the system for less than one year averaged less than five e-prescriptions per week, those using e-prescribing for more than one year averaged 17 e-prescriptions per week, and those using e-prescribing for more than three years averaged 33 e-prescriptions per week.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Synthesis and Dissemination

Improving Otitis Media Care with Electronic Health Record-Based Clinical Decision Support and Feedback

Principal Investigator:	Forrest, Christopher, M.D.
Organization:	Children's Hospital of Philadelphia
Mechanism:	RFA: HS07-006: Ambulatory and Safety Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017042
Project Period:	September 2007 – February 2011
AHRQ Funding Amount:	\$877,011

Summary: Several problems in the treatment of otitis media (OM)—infection of the middle ear— in children arise from physicians' lack of awareness of national guidelines on judicious use of antibiotics and the overuse of antibiotics in OM treatment. This issue can be mitigated through health information technology (IT). This purpose of this project was to develop, test, and disseminate a health IT intervention to improve the quality of OM care and reduce the amount of resources used in its treatment.

The intervention used the Children's Hospital of Philadelphia's (CHOP's) electronic health record (EHR) to integrate care over time and to supply physicians with the knowledge they need at the point of care. The full intervention consisted of: 1) a method for linking all services a patient receives from any physician into clinically logical clusters called 'episodes-of-care'; 2) clinical decision support (CDS) for medications and referrals to specialists based on the best available scientific evidence; 3) feedback on past performance of OM care provided by physicians; and 4) physician training on use of tools. The study randomly assigned 24 primary care practices into groups for usual care with feedback reports; usual care without feedback reports; full intervention without feedback reports; or full intervention with feedback reports.

The project was conducted in the CHOP Pediatric Research Consortium, which includes all primary care practices in the CHOP network. The CHOP network uses an ambulatory EHR that affords immediate, secure electronic access to clinical information, and communication at the point of care.

Specific Aims:

- Develop and pilot test the OM health IT intervention. **(Achieved)**
- Examine overall effect of health IT intervention and the independent contribution of physician feedback on quality of care (the primary outcome). **(Achieved)**
- Assess the effects of the intervention on the secondary outcomes of resource use and clinician adoption of the technology. **(Partially Achieved)**
- Work with members of their advisory board, including the American Board of Pediatrics, National Committee for Quality Assurance, and the Child Health Corporation of America to disseminate the work to child health professionals nationally. **(Achieved)**

2011 Activities: The research team used a 1-year no-cost extension to complete data analysis and develop several papers on different components of the research and results. The project was completed in February 2011.

Preliminary Impact and Findings: Practices randomized to clinical decision support were significantly more likely to adhere to guidelines for management of OM than were control practices. There was marked variation in physician adoption of CDS. Across both followup periods (months 13 and 33), the average practice-level use of the CDS tool was 17.1 percent (range 4.8-45.1 percent across practices) of eligible visits. Prospectively assigning encounters to a treatment episode allows for decision support at the point-of-care to account for past treatment decisions; however, developing these methods is highly resource-intensive and requires analysis of both structured and unstructured (free text) data. Providing decision support at the point-of-care is an effective strategy for improving adherence to quality metrics where treatment is encouraged. Retrospective performance feedback significantly impacted only one quality metric, but did halt decreasing tool use. The availability of clinical decision support does not assure that clinicians will use it. Creating flexible decision support systems that provide needed knowledge at the point-of-care to improve quality requires substantial investments in clinical informatics.

Target Population: Otitis Media, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* *This target population is one of AHRQ's priority populations.*

The Bettering Lives Utilizing Electronic Systems (BLUES) Project: Improving Diabetes Outcomes in Mississippi with Health Information Technology

Principal Investigator:	Fox, Karen, Ph.D.
Organization:	Delta Health Alliance, Inc.
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health IT (R18)
Grant Number:	R18 HS 017233
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$1,163,573

Summary: The Delta Health Alliance (DHA), which has sponsored the Delta Diabetes Project (DDP) over the past several years, initiated the Bettering Lives Utilizing Electronic Systems (BLUES) Project in September 2007 to determine whether utilization of health information technology (IT) in diabetes management would enhance health care delivery and improve patient's health outcomes. This pilot project examined the cost-effectiveness of using well-designed, comprehensive health IT in diabetes management practices at several ambulatory clinics in Mississippi. The research team collected measures related to process and outcomes associated with diabetes, such as those for blood pressure, HbA1c, low-density lipoprotein (LDL) and patient satisfaction. Additionally, the study looked at the impact of health IT on medication management and timeliness of care.

Four diabetes management clinics participated in this study: two in an urban setting and two in a rural setting, each clinic employing the same model of diabetes care. Two clinics implemented an electronic health record (EHR) (one urban, one rural), and two remained paper-based practices (one urban, one rural). Outcome variables were measured at baseline and at 6-month intervals for a period of 2 years, yielding a maximum of five total time points.

Overall, the results in terms of EHR versus non-EHR sites were mixed, although the LDL results were consistent with a positive effect of the EHR. The lessons learned were invaluable in demonstrating that installation of EHRs alone does not improve outcomes for chronic disease; it must include significant clinician training, support, and use of health IT tools such as clinical decision support.

Specific Aims:

- Implement an EHR system in two existing diabetes management clinics, focusing on integration of the EHR into clinician workflows. **(Achieved)**
- Evaluate the impact of the EHR system on clinical processes of care and patient outcomes. **(Achieved)**
- Produce and distribute a generalizable, replicable model of care for implementing an integrated health IT system for diabetes management care throughout the United States. **(Achieved)**

2011 Activities: During the initial data analysis in late 2010 and early 2011, one test clinic continuously demonstrated clinically different outcomes from the others. This difference caused the project team to review the methods used in the original queries to ensure they were the same as in the other test clinic. Upon further review, the team noted that there was a technological problem with one of the servers at the

University of Mississippi Medical Center from which the data was pulled. This resulted in a significant difference in the way the data was pulled between the two test sites. Therefore, activities in 2011 focused on re-running the data and correcting the data issue with this clinic.

The project team used a 12-month no-cost extension to adjust the data collection between comparison sites and complete the project aims. Meanwhile, the team was conducting the background work to prepare for the data analysis and looking at comparative research to inform any potential journal articles that could result from this study. Once the data issue was resolved, data analysis was conducted relatively quickly and manuscript development began. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. The project ended in September and the study team delivered a final report to AHRQ in December.

Impact and Findings: This pilot study provided many lessons about the implementation of EHR projects as well as necessary steps for improving health care and health outcomes for diabetes patients. The project revealed some inherent difficulties in collecting data in order to evaluate the impact of obtaining and using an EHR, such as the necessity of a paper chart control group and the large number of missing lab values in the initial EHR data. It is thought that as the EHR system continues to develop, the data generated from it will most likely improve.

Findings in this study indicate that simply deploying EHRs does not improve health care for diabetic patients. However, EHRs coupled with training and appropriate tools can result in improved process-of-care measures (timely and appropriate exams and lab testing, for example), greater patient satisfaction, enhanced diabetes-related outcomes, improved provider satisfaction, better medication management, increased patient safety, and reduced care-related costs. These findings imply that the promotion of best practices for disease management and care coordination in conjunction with the implementation of health IT improve health outcomes for patients.

The data and information collected from this study will be important in designing and securing future programs that are addressing the deficiencies often seen in the Mississippi Delta. Rural clinics need technological literacy and training to implement health IT, including EHRs, and serve a disparate population in a more connected way. Future studies might focus on how to best implement training programs in clinics to speed the process of EHR implementation and clinician training.

Target Population: Adults, Chronic Care*, Diabetes, Medically Underserved, Racial or Ethnic Minorities*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

eHealth Records to Improve Dental Care for Patients with Chronic Illnesses

Principal Investigator:	Fricton, James, D.D.S., M.S.
Organization:	HealthPartners Research Foundation
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Technology (IT) (R18)
Grant Number:	R18 HS 017270
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$996,737

Summary: An electronic dental record (EDR) integrated with an electronic medical record (EMR) and personal health record (PHR) provides a unique opportunity to improve the dental care of patients with chronic conditions by alerting them to special care requirements and alerting dentists at the point-of-care. Furthermore, the integration of an EMR, PHR, and EDR into an integrated electronic health record (EHR) system improves health information exchange, communication, and cost effectiveness of care, particularly for patients with chronic illnesses.

This project involved a randomized clinical trial to evaluate the effectiveness of simple reminders in an integrated EHR to improve the quality and safety of dental care for patients with chronic illnesses. The study involved 102 dentists from 15 dental clinics within HealthPartners, a large integrated health system in Minnesota that consists of a dental group, a medical group, a hospital system, a health plan, and a dental plan. The patients in the study population had special dental care needs as a result of four chronic conditions: diabetes mellitus, congestive heart failure, chronic obstructive pulmonary disease, and xerostomia (dry mouth) caused by medications or related conditions. The interventions were designed to address how and to whom special dental care needs are communicated. The impact of two clinical decision support (CDS) approaches was compared with a usual-care control group. Dental providers were randomly assigned to one of the intervention groups or the control group. The interventions were: 1) a reminder to the patient delivered by a PHR e-mail or, if e-mail was not available, over the phone by the dental clinic staff or by postal mail; or 2) a point-of-care reminder to the dentist through the EDR.

This study demonstrated that utilization of clinical guidelines for medically compromised patients can be improved with CDS using electronic dental records with provider and patient activation strategies. The clinical implication is that, as our population ages, dentists must adapt care for medically compromised patients to maintain their safety and quality of services.

Specific Aims:

- Determine the effectiveness of integrated EMR-based interventions toward changing dentist and patient behavior. **(Achieved)**
- Determine the impact of an integrated EMR-based intervention upon the use of emergency and or restorative dental care. **(Achieved)**

- Produce and distribute a generalizable, replicable model of evidence-based care recommendations for implementing an integrated health information technology system for diabetes and other chronic illness management within dental care practices throughout the United States. **(Achieved)**

2011 Activities: The focus of activity was on completing data analysis and writing up the study findings and a final report. The third manuscript to result from this project, [Electronic Health Records Improve the Use of Clinical Care Guidelines for Medically Complex Patients](#), was published as the cover story in the October 2011 issue of the *Journal of the American Dental Association*. Two additional manuscripts, “eHealth Records Improve Quality of Care for Medically Complex Patients” and “The Impact of eHealth Records on Adverse Events in Medically Complex Patients,” were submitted to journals for consideration. Two grant applications were also submitted to the Agency for Healthcare Quality as an extension of this grant.

Due to challenges with data collection, particularly in accessing data from the EDR earlier in the project, a 12-month no-cost extension was necessary to complete the project, which ended in September 2011. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target.

Impact and Findings: Participants in both the provider and patient activation groups increased use of the system during the first 6 months to access the guidelines for all patients. They also improved the accuracy of documenting medical history and use of preventive care as recommended in the guidelines. The intervention did not have an impact on patient complications (which were relatively low) between groups. Provider activation was more effective in promoting access to the guidelines than was patient activation. However, providers did not sustain their high level of use of the system.

In general, the principal findings of the study include:

1. The development and implementation of evidence-based guidelines improved safety and quality of dental care in patients with medical conditions.
2. Reminder alerts to both dentists and patients increased utilization of care guidelines by 440 percent and 221 percent, respectively, from baseline, while the control group had no increase.
3. Both provider and patient alerts had a generalizable, sustainable effect of increasing the providers reference care guidelines for all patients compared with usual care.
4. Automated provider alerts in the EDR were more effective at encouraging the use of care guidelines than personalized alerts sent to patients.
5. The CDS triggered a response by about 79 percent of all dental providers, leaving only 21 percent nonresponsive to the system.
6. There was a clear trend toward increasing the frequency of correcting errors in medical history reconciliation by dental providers as triggered by the CDS.
7. The CDS increased the use of preventive dental encounters from pre- to post-intervention periods per patient, as suggested by the guidelines.
8. The CDS did not reduce the number of dental or medical complications per patient per year.

This study demonstrates that CDS that alerts providers through EDRs or alerts patients through PHRs can improve dental providers' review of clinical care guidelines for patients with medically complex conditions, improve medication reconciliation, and improve preventive care. However, dental providers' use of the CDS system declined after the first 6 months despite the continued use of alerts. This suggests that dentists and hygienists either did not feel the need to continue reviewing the clinical care guidelines or the alerts became less effective. Future research is needed to determine which additional CDS components will increase the percentage of dental providers who use it and to improve transferability and scalability of a system to more dental providers while maintaining high acceptability.

Target Population: Adults, Chronic Care*, Chronic Obstructive Pulmonary Disease, Congestive Heart Failure, Diabetes, Other Conditions: Xerostomia

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Pharmaceutical Safety Tracking (PhaST): Managing Medications for Patient Safety

Principal Investigator:	Gardner, William, Ph.D.
Organization:	Children's Research Institute
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IT) (R18)
Grant Number:	R18 HS 017258
Project Period:	September 2007 – May 2011
AHRQ Funding Amount:	\$1,156,142

Summary: Pharmaceutical Safety Tracking (PhaST) is a health information system that assists clinicians' management of medications in ambulatory settings. It is an automated system for monitoring medication adherence, side effects, and patient symptoms using research-based assessment procedures administered via interactive voice response (IVR) telephony. The PhaST system was developed to improve monitoring efforts of pediatric antidepressant use. This project compared PhaST to usual care on measures of patient and provider satisfaction, patient outcomes, and measures of the quality of medication management, such as rates of patient medication non-adherence.

To compare the use of PhaST to usual care, the project conducted a randomized trial in a large, urban, and specialty mental health system that primarily serves a Medicaid population. The project enrolled youths who were receiving new prescriptions for antidepressants to assess them for adverse events at baseline and 1-, 2-, and 3-month milestones. Patients were recruited based on physician referral and included 153 families of children aged 6-17 years who had been prescribed an antidepressant in the past week. Families were randomized to a PhaST or treatment-as-usual (TAU) regimen. PhaST families received seven IVR screening calls over 3 months.

Because the monitoring calls were able to screen for potential concerns and provide routine reports, on-call triage, and patient contact, subsequent physician contact or action was needed only when an immediate risk was detected. The technology also simplified the monitoring process for the patient's family, since calls were conveniently scheduled and additional transportation or treatment costs occurred only if medically required.

The goal of PhaST was not to replace clinician visits with telephone calls, but to improve safety and remediate access problems by augmenting communication channels already available to families.

Specific Aims:

- Determine whether PhaST is superior to usual care on measures of system process. **(Achieved)**
- Determine whether PhaST is superior to usual care on measures of patient and provider outcomes. **(Achieved)**

2011 Activities: Obtaining complete medical records on study participants had been a challenge in early phases of the project. The project team exercised the remainder of a 6-month no-cost extension period

to focus on obtaining complete records on all remaining study participants, organize the analytical data, develop a final report, and lastly, disseminate findings in a manuscript titled [An automated clinical monitoring system benefits patients, lightens loads on families and providers](#) and published in the November 2010 volume of Behavioral Healthcare. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. The project concluded in May 2011.

Impact and Findings: Dr. Gardner and his study team tracked all call attempts and call completions in the PhaST group (by design, no calls were made in the TAU group). Of the 76 PhaST children, the team reached 74 (97 percent) at least once. Of the 74 participants contacted, the number of completed calls ranged from 3 to 13 ($M = 6.6$, $SD = 1.2$). Thus, the average number of successful calls was close to the desired target.

Overall, the system was shown to maintain and establish contact with patients, and it achieved its targeted rate of followup supervision. The screen has strong psychometric properties, and families used it to report significant rates of mental health problems. This information increased the amount of data on children's mental health condition available to clinicians, as shown through medical record reviews. Preliminary analyses showed that PhaST enables clinicians to have substantially increased information about patients, without the burden of significant additional tasks. Dr. Gardner is pursuing additional analyses into the comparison of chart-documented adverse events against adverse events as determined by an examiner blind to the patient's randomization. He will also compare PhaST and usual care on measures of patient and provider satisfaction, patient outcomes, and measures of the quality of medication management such as rates of patient medication non-adherence.

Target Population: Medicaid, Mental Health/Depression, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

RxSafe: Shared Medication Management and Decision Support for Rural Clinicians

Principal Investigator:	Gorman, Paul, M.D.
Organization:	Oregon Health & Science University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017102
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,200,000

Summary: It is widely recognized that health information technology (IT) can improve medical care and patient safety, but questions remain about how best to put health IT systems into practice. This project sought to provide important information about how to integrate decision support into clinical practices to improve the quality and safety of medication management for people with chronic illnesses. This project investigated the feasibility and impact of novel approaches to clinical decision support in multidisciplinary ambulatory care, emphasizing high-risk transitions of care. The project developed technology to support shared medication management for persons with chronic conditions. The health IT system, RxSafe, was used to facilitate clinician decisionmaking and improve outcomes for patients and providers in the management of chronic conditions. Ultimately, the project aimed to show improvements in medication management by: 1) providing the means to effectively share medication information; 2) making any corrections or improvements made by one team member to the regimen visible to all team members; and 3) providing clinicians using the system with access to evidence-based information at the time and place it is needed.

This project is a collaboration between community-based nurses and physicians providing ambulatory services in an Oregon coastal community, a multidisciplinary team of university-based investigators with expertise in medicine, nursing, medical informatics, and computer science, and the Oregon Rural Practice-based Research Network, which provided the infrastructure, coordination, and support. Clinical settings for the project were independent clinic practices in two coastal communities, local home health services, and transitions in care into and out of the sole community hospital and its emergency room. The patient focus was on community-dwelling persons with chronic conditions on multiple medications. The choice of these specific innovations was informed by experience with development and early deployment of RxSafe, a system that consolidates medication lists of patients in long-term care to integrate information for providers involved in prescribing, dispensing, administering, or monitoring medications.

Specific Aims:

- Enhance clinician cognitive performance in medication management tasks by exploiting the underlying semantics of medication lists to improve the organization and presentation of medication list information. **(Achieved)**

- Implement medication list management tools that are integrated into clinician-specific and task-specific workflows to support medication reconciliation at high-risk transitions as well as in ongoing ambulatory care. **(Achieved)**
- Increase the effectiveness of medication management activities of clinicians in multiple roles by improving their coordination and communication using shared medication management tools. **(Achieved)**
- Employ evolving standards and architectures to link external, machine-actionable, evidence-based clinical information in context-appropriate and user-appropriate ways to support shared medication management by clinicians practicing in ambulatory settings. **(Achieved)**

2011 Activities: A 1-year no-cost extension allowed for the completion of final project activities including field observations of clinical medication management produced descriptions of cognitive resources and task models. The team evaluated medication management open-source software solutions including MyRxPad, MyMedicationList, and OpenMRS platform. The team configured these clients to interact through the versioning system (SyncRx) and explored the usefulness of this technology in prototype testing to determine the requirements and challenges to its development and deployment.

The team completed the “pipeline” prototype, demonstrating the Web-based clinical decision support model that would allow composition of independent medication information related services. The demonstration included services for parsing, identification using RxNorm, and classification using the National Drug File Reference Terminology of medication information, and a software harness to allow composition of these and other medication management services. Dr. Gorman did not submit a report in the AHRQ Research Reporting System during 2011 with a status of activities or project spending. The project was completed in August 2011.

Impact and Findings: The project found that arrangement of information is important to clinicians and may be an important form of cognitive support. Recall of medication list items corresponded to experience level, with attending physicians recalling a median of 14 of 20 medications overall, residents a median of 10.5 of 20 items, and preclinical students a median of 8.5 items. Student recall was greater with an organized medication list, but resident and attending physician recall was not affected by order, which contrasted with the teams’ expectation that the organization of medication information would improve recall yet found data to support this for novices only. However, it may be that processing of the list by the clinician is the more important factor. Recall by experts was high in either case, but subjectively they reported it was easier to recall the list items when they had to reorganize the lists themselves.

Medication reconciliation may occur as an isolated procedure designed to document compliance with regulations. However, medication management in long-term care was a richer, more robust, and more complex process, which is distributed, dynamic, collaborative, and continuous, involving multiple health professionals separately performing complementary tasks in different settings over time. The project was able to demonstrate the technical feasibility of a synchronization system using open-source tools, but further exploration of this prototype is limited to use of open-source tools, including OpenMRS, because of the difficulty of interacting with proprietary closed systems produced by electronic medical record vendors.

A prototype that demonstrated the feasibility of independent Web-based decision support services interacting in a service-oriented architecture over a network was developed. This prototype will allow

further exploration of the technical issues encountered, such as differences in drug terminologies used in existing systems, speed or access constraints of Web-based knowledge services, inclusion of extraneous data in medication information fields of local systems, and agreement on useful common classification schema for medication information.

Target Population: Adults, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Improving Post-Hospital Medication Management of Older Adults With Health Information Technology

Principal Investigator:	Gurwitz, Jerry, M.D.
Organization:	University of Massachusetts Medical School - Worcester
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017203
Project Period:	September 2007– August 2011
AHRQ Funding Amount:	\$1,199,952

Summary: The project employed a randomized controlled trial design to test the ability of a health information technology (IT)-based transitional care intervention that enhanced medication reconciliation and therapeutic monitoring to improve the quality and safety of patient monitoring and medication management. The intervention was integrated into the EpicCare Ambulatory electronic medical record (EMR), and focused specifically on the transition from inpatient to ambulatory settings for older adults who have multiple comorbid conditions and are prescribed high-risk medications. This research examined the quality of followup, outpatient clinician workflow, occurrence of adverse drug events (ADEs), and health care utilization, to gain insight into the effective use of clinical alerts and coordinated delivery of actionable information to outpatient clinicians in the management of ambulatory elderly patients after hospital discharge.

Management of complex information and coordination of data sharing across multiple settings often hamper clinician workflow in the post-hospitalization setting. The intervention addressed these special challenges by automating key steps in the transition of care from the hospital to home, including: 1) expediting and facilitating discharge followup appointment scheduling, including monitoring for no-shows; 2) generating medication lists that alert the primary care provider to key therapeutic additions; and 3) generating patient-specific therapeutic monitoring recommendations for high-risk medications in the post-hospitalization period.

Specific Aims:

- Evaluate the impact of automated scheduling alerts on the rate of followup to an outpatient provider within 14 days of hospital discharge. **(Achieved)**
- Evaluate the impact of automated monitoring alerts on the prevalence of appropriate monitoring for selected high-risk medications at 30 days from the time of hospital discharge. **(Achieved)**
- Evaluate the impact of a health IT-based transitional care intervention on the incidence of ADEs within 45 days of hospital discharge. **(Achieved)**
- Evaluate the impact of a health IT-based transitional care intervention on the rate of hospital readmissions and emergency department visits within 30 days of discharge. **(Achieved)**

- Assess (by level of comorbidity, number of medications, and use of specific high-risk medications) whether a health IT-based transitional care intervention is more effective in subgroups of patients. **(Achieved)**
- Determine costs directly related to the development and installation of the health IT-based transitional care intervention. **(Achieved)**

2011 Activities: The project team conducted two analyses. The first assessed the impact of the intervention on visits to the outpatient provider, hospital readmissions, and emergency department visits. The second analysis determined the investments of time and effort required to develop, test, and launch the EMR-based post-discharge intervention. The latter analysis is a preliminary step for the planned return-on-investment analysis.

The team of clinical research pharmacists continued to review the EMR for ADEs. They also initiated adjudication sessions with the physician reviewers to classify the abstracted events. Due to delays in programming of the EMR, the project team used a 1-year no-cost extension. As last self-reported in the AHRQ Research Reporting System, project progress was completely on track and project budget spending was on target. The project was completed in August 2011.

Impact and Findings: Overall, the project did not find significant improvements in visit rates to outpatient providers following discharge from the hospital, laboratory monitoring in response to alerts, adverse drug event rates, or rehospitalization and emergency department visit rates relating to the intervention.

Visits to the outpatient provider: There were 1,024 visits (54.4 percent of subjects) to an outpatient provider within 14 days of hospital discharge among patients in the intervention group, and 964 in the control group (53.6 percent of subjects).

Laboratory monitoring: Appropriate monitoring for selected high-risk medications within 45 days from time of hospital discharge was 2.35 percent in intervention groups and 1.11 percent in control groups.

Adverse drug events: The first 1,000 hospital discharges for all patients included in the study were comprehensively evaluated, with 514 discharges in the intervention group and 486 discharges in the control group. Among 514 discharges in the intervention group, 107 discharges were identified (20.8 percent), of which there was at least one adverse drug event during the 45-day period after discharge. Among 486 discharges in the control group, 82 discharges were identified (16.9 percent), of which there was at least one adverse drug event during the 45-day period after discharge.

Hospital readmission and emergency department visits: During the 12-month intervention period, in the 30-day period following hospital discharge of the patient, there were 1,884 eligible discharges and 241 rehospitalizations in the intervention group (12.8 percent), and 1797 eligible discharges with 235 rehospitalizations in the control group (13.1 percent). For the same period, again looking at the 30-day period following hospital discharge of the patient, there were 271 emergency department visits in the intervention group (14.4 percent), and 272 emergency department visits in the control group (15.1 percent).

Costs: The total estimate of costs for personnel involved in developing and implementing the transition intervention was \$76,314. The time spent on the project across all personnel was 1,308 hours.

Target Population: Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Safety Through Enhanced e-PreScribing Tools (STEPStools): Developing Web Services for Safe Pediatric Dosing

Principal Investigator:	Johnson, Kevin, M.D., M.S.
Organization:	Vanderbilt University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health IT (IQHIT)
Grant Number:	R18 HS 017216
Project Period:	September 2007 – February 2011
AHRQ Funding Amount:	\$1,157,753

Summary: The Safety Through Enhanced e-PreScribing Tools (STEPStools) project assessed a generally-available knowledgebase for pediatric medication management’s impact on quality and safety. STEPStools constructed, pilot tested, and evaluated available tools that provide medication-specific knowledge about dose rounding and extemporaneous formulations necessary for small children. The project also evaluated the effectiveness of using a service-oriented architecture to distribute knowledge, which is an emerging method for knowledge management and dissemination.

The project committed to releasing this database as a toolkit, initially as a dataset available publicly through the Agency for Healthcare Research and Quality, and ultimately through the National Library of Medicine and RxNorm, the drug nomenclature for standardizing the representation of clinical drugs. The project informs the vendor community and general public about the utility of Web services as a tool for knowledge dissemination, and is specifically proposed as a method to distribute clinical decision support. In addition, the American Academy of Pediatrics (AAP) has contributed to this knowledgebase and will enable its availability to e-prescribing developers for many years.

Specific Aims:

- Convene a panel of AAP and American Medical Informatics Association experts to construct a knowledgebase of actionable data to guide e-prescribing systems in the appropriate rounding of calculated doses and selection of extemporaneous medication formulations. **(Achieved)**
- Develop Web services and Web browser client to allow browsing this knowledgebase. **(Achieved)**
- Evaluate the usability and content validity of these Web services through a series of pediatric prescribing use-cases, site visits to pilot users, and an examination of the error rate of prescriptions generated with and without the use of these Web services. **(Achieved)**

2011 Activities: The team completed the analysis of the validity of the rounding tolerances and the degree to which STEPStools recommendations were in agreement with the prescribing practices of practitioners. Due to delays in collaborations with vendors, Dr. Johnson used a 6-month no-cost extension to continue the evaluation through February 2011.

Impact and Findings: The team conducted a concordance analysis using a 24-item survey of test cases to assess the validity of the rounding tolerances and the degree to which STEPStools recommendations were in agreement with the prescribing practices of practitioners. The survey was piloted with 10 subjects and then distributed to a total of 172 pediatricians. Eighty test cases were compared. Of these, there was

complete concordance between the recommended dose/formulation and the prescribed dose/formulation for 31, or 39 percent of the cases. Forty-four complete responses were received after six reminders over the course of 3 months, for an overall response rate of 26 percent.

When combined with the data from all test cases, STEPStools either matched or exceeded the performance of the test cases in 46 (84 percent) of the cases where it was able to provide a recommendation. Results confirm that Web services are a feasible knowledge and tool distribution method. Some of the initial findings include the types of information that providers find useful in the tool. For example, the tool scores a variety of answers, starting from the top-choice medication, to one that would not be recommended. The team also learned what information providers think are extraneous.

Interviews were conducted before STEPStools' implementation (environmental scan) and after implementation (summative evaluation) with 11 subjects. The sample of prescribers and prescribing agents consisted of physicians and nurses representing general pediatrics, and three different pediatric specialties who regularly use the e-prescribing system RxStar to generate prescriptions. Users see potential for a tool to assist with rounding, however they would like more flexibility in recommendations, e.g., specific medication schedules and high-dose Amoxicillin. Certain subspecialties prescribe compounded medications more frequently than others; these prescribers found the added compounded medications in the list to be useful.

The project team also increased its understanding of how to link knowledgebases when working with vendors. RxNorm is used as a link between the rounding knowledgebase and the vendor-supplied knowledgebase. The RxNorm creates unique identifiers for the medication name (i.e., Amoxicillin), the routed form of the medication (Amoxocillin Oral), and the dispensable form of medication (Amoxicillin 400 mg/5mL Oral Suspension). Although the unique identifiers were expected to link with other knowledgebases, a number of unanticipated barriers arose. Another finding was that inactive ingredients in compounds are not typically included in RxNorm and are not coded in many vendor systems. Therefore, inactive ingredients are not included in the knowledgebase. Additional work should improve the performance of the rounding algorithm and the number of medications it is able to round.

Target Population: Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Synthesis and Dissemination

** This target population is one of AHRQ's priority populations.*

Electronic Prescribing and Electronic Transmission of Discharge Medication Lists

Principal Investigator:	Kaushal, Rainu, M.D.
Organization:	Joan and Sanford I. Weill Medical College of Cornell University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017029
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,187,674

Summary: This project consists of three studies that assessed the impact of health information technology (IT) on patient safety in the ambulatory setting. The first was a multi-center pre-post study measuring the impact on medication errors when switching from a locally-developed electronic health record (EHR) with an electronic prescribing (e-prescribing) system to a vendor-based system. The second was a qualitative study of physicians using one-on-one-interviews and direct observation to understand variations in human-computer interactions with this new e-prescribing system, and how user patterns or system features may influence medication errors. The third study used a cohort controlled design to evaluate the effect of electronically transmitting discharge medication lists from the hospital to the ambulatory setting on: 1) medication discrepancies at the first ambulatory visit following discharge; and 2) adverse drug events (ADEs) 30 days post-discharge.

These studies added to the knowledge of medication safety and the impact of health information exchanges on patient safety. In addition, by including a qualitative component on human-computer interactions, this project yielded critical insights as to why certain health IT interventions work while others do not, and how future interventions should be designed to better align themselves with physicians' workflow. The studies also have implications for institutions and practices as they transition from one EHR to another. If error rates vary greatly between systems, there are potential policy implications for more stringent certification criteria of e-prescribing to ensure medication safety.

Specific Aims:

- Measure the effects on medication errors of transitioning from one e-prescribing system to another in the ambulatory setting. **(Achieved)**
- Measure the effects on human-computer interactions of transitioning from one e-prescribing system to another in the ambulatory setting. **(Achieved)**
- Evaluate the impact on medication discrepancies of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting at the first ambulatory visit following discharge. **(Achieved)**
- Evaluate the impact on ADEs 30 days post-discharge of electronic transmission of medication lists at discharge from the hospital to the ambulatory setting. **(Achieved)**

2011 Activities: The first study, measuring the effects on medication errors and data collection when transitioning from one electronic prescribing system to another, was previously completed. For the second study, a qualitative study measuring the effects on human-computer interaction of this same transition, data from two sets of interviews were analyzed and a manuscript was submitted for publication. The third study evaluated the impact on medication discrepancies and ADEs of electronic transmission of medication lists at discharge. An experienced research nurse identified medication errors in the data and ADEs experienced by the patient. All medication errors were reviewed by two experienced physicians who used the tool to rate the severity of the errors and ADEs. Due to delays with data collection, Dr. Kaushal used a 1 year no-cost extension to complete data cleaning and analysis. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. This project was completed in August 2011.

Impact and Findings: For the first study, the rates and types of prescribing errors made by physicians were assessed at four time periods: 1) baseline, when physicians were using the locally-developed EHR with minimal clinical decision support for e-prescribing; 2) three-months post-implementation of the commercial EHR with more advanced clinical decision support for e-prescribing; 3) one-year post-implementation; and 4) two-years post-implementation. The research team found that error rates were highest at baseline and lowest at 2 years. Improvements were primarily attributed to reducing inappropriate abbreviation errors. Other error types increased and remained elevated at 1-year post implementation, suggesting that transitioning from a locally-developed to a commercial EHR for e-prescribing can reduce certain errors; however, important safety threats remain. Over time, as users become accustomed to a system and iterative refinements are made, safety may continue to improve. Recognizing the challenges associated with transitions and refining clinical decision support within systems may help maximize safety benefits and allow potential safety threats to be better anticipated and managed.

For the second study, Dr. Kaushal used qualitative techniques to assess providers' perceptions of the two systems. The results again indicated that the transition was difficult for the providers, even though the providers all had experience using computers systems in clinical practice. Providers want systems that improve speed and ease of prescribing. Systems that were complicated were disliked, even when they had more robust clinical decision support. Providers overwhelmingly preferred certain features of the new vendor-based system, including remote access. Over time, providers became more positive in their perceptions about the new system, including its perceived impact on safety. Dr. Kaushal found that perceived system usability and efficiency for order writing were key determinants of provider satisfaction.

For the third study, 162 subjects completed all parts of the study, of which 82 patients were in the intervention arm. Overall, Dr. Kaushal found that medication discrepancies were extremely common. The intervention did not significantly reduce these discrepancies or ADEs for patients in the intervention group. Cardiovascular drugs, gastrointestinal drugs, non-narcotic analgesics, and anti-coagulants were the classes of medications with the highest error rates. The most common type of discrepancy detected was omitted medications. Risk factors for medication errors and ADEs included taking 11 or more medications, having two or more outpatient visits during the previous year, having less than a high school education, and receiving care from an intern as opposed to a senior resident.

Overall, this study underscores the importance and challenges of developing interventions that facilitate medication reconciliation while supporting provider workflow. The results also provide important information on the most common types of medication errors. This information can help providers identify

patients who may be at higher risk for medication errors in an effort to reduce their risk of harm from medication discrepancies.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

Evaluation of a Computerized Clinical Decision Support System and EHR-Linked Registry

Principal Investigator:	Kopal, Helene, M.P.A., M.P.H.
Organization:	Primary Care Development Corporation
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health IT (R18)
Grant Number:	R18 HS 017167
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$1,132,569

Summary: Hypertension affects millions of adults in the United States, many of whom are among the underserved populations that bear a disproportionate burden of chronic disease and illness. Community health centers (CHCs) are a major source of care for the underserved. This project was designed to analyze the efficacy of office-based electronic decision support and provider feedback in improving hypertension control in CHCs. Dr. Kopal and her team hypothesized that a clinical decision support system (CDSS) and electronic registry-linked performance feedback would be more effective at improving hypertension control than a standard-care electronic health record (EHR) in CHCs that serve low-income, primarily Latino patients.

Project collaborators included Partners Primary Care Development Corporation (PCDC); Open Door Family Health Center (Open Door), a not-for-profit organization that operates four primary care sites serving low-income, primarily Latino immigrants; New York University College of Dentistry and School of Medicine; and the Columbia University Mailman School of Public Health. The large number of minority and low-income patients served by Open Door CHCs, as well as the existing practice-based research infrastructure provided by PCDC and Open Door, offered a unique opportunity to target an underserved, hard-to-reach immigrant population and investigate the efficacy of these interventions.

The study team used qualitative and quantitative methods to meet three overarching goals: 1) assess the impact of health information technology (IT) on outcomes in ambulatory settings; 2) investigate novel methods and evaluate existing strategies for clinician use of health IT in ambulatory settings; and 3) devise strategies for safe, successful health IT adoption. Specifically, the team analyzed the effects of a multi-component, technology-driven quality improvement intervention on hypertension control. A pre- and post-intervention comparison on blood pressure (BP) outcomes and clinical process measures was conducted. On a monthly basis, the project team extracted data from the eClinicalWorks EHR and estimated the effect of the intervention using Autoregressive Integrated Moving Average modeling. The team evaluated changes in BP control using an ANOVA test for significance of the BP trends over the 36-month study period. Additionally, pre- and post-intervention surveys and structured interviews of providers were conducted.

Specific Aims:

- Test whether an office-based EHR with decision support and registry-linked provider performance feedback is more effective in improving hypertension control than a standard EHR alone. **(Achieved)**

- Assess the implementation process, and delineate factors that influence adoption of the EHR-supported quality improvement intervention. **(Achieved)**

2011 Activities: Due to a minor delay in data analysis, the project was underspent in the latter part of 2010; therefore, the project team used a 12-month no-cost extension to complete the analysis and record the results. As last self-reported in the AHRQ Research Reporting System, project progress was on track and the budgeted funds were somewhat underspent. However, with the focus of activity in 2011 on completing the qualitative analysis, developing an implementation manual, drafting three separate manuscripts for potential publication, and developing a final report, the project spending was on track at the completion of the project in September 2011.

Impact and Findings: Patients had an average of 8.84 (SD=6.62) clinic visits during the 36-month study period (mean of five visits both pre- and post-intervention). Hypertension control was significantly greater post-intervention compared with the baseline period. Process measures also improved significantly. Logistic regression with generalized estimating equations showed that patients were 1.5 times more likely to have BP controlled post-intervention than pre-intervention. Participants found different components useful, but overall this study showed improved adherence to guidelines and more aggressive, systematic, and focused attention on a priority condition—hypertension—on the part of providers using CDSS.

Three aspects of this study appear to stand out as critical to improving hypertension care and outcomes:

1. A multicomponent intervention that included CDSS and provider performance feedback promoted adherence to hypertension clinical guidelines and was associated with improvements in blood pressure control. Among the CDSS features, there was something that worked for everyone. The evidence suggests it was the synergy of the intervention components that lead to the positive outcomes.
2. The process of working with providers and tailoring the intervention allowed for the best fit between the goals of the intervention and practice conditions. The project team selected features of the intervention that did not mandate practice patterns. Rather, features were selected based on how easy they would be to build within the current eClinicalWorks platform; on skills, resources, and preferences of the clinic; and the on usability, acceptability, and ease of use from the provider's perspective.
3. In an effort to improve health outcomes, this CDSS intervention was implemented in the context of a quality improvement effort, one component of practice change needed to reach the targets for each quality indicator. Several additional factors were also identified as facilitators of success. They included organization culture, leadership, rigorous implementation process, provider engagement, and the health care setting's ability to process patient data. Strength in these areas helps make health IT interventions successful.

Target Population: Hypertension, Low-SES/Low Income*, Medically Underserved, Racial or Ethnic Minorities*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Optimizing Medication History Value in Clinical Encounters With Elderly Patients

Principal Investigator:	Lapane, Kate, Ph.D.
Organization:	Virginia Commonwealth University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017150
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$1,199,989

Summary: Electronic prescribing (e-prescribing) combined with a medication history may assist physicians in more fully understanding adherence issues with older patients, promoting clinician-patient partnerships, empowering patients to participate in treatment decisions, and allowing patients to negotiate acceptable medication regimens that are more amenable to patient follow-through. Some e-prescribing systems are integrated with pharmacy chains, making medication histories and information on unfilled prescriptions available to clinicians.

This project was designed to assess whether clinician training on medication history could improve its use during the clinical encounter and optimize improvement in the quality of medication management in ambulatory settings. In addition, the project examined the role of electronic medication management tools in helping clinicians to identify potential medication management problems and to monitor complex medication regimens.

Dr. Lapane’s team developed geriatric-specific algorithms to identify potential medication management issues—such as polypharmacy, potentially inappropriate medication use, duplicative therapy, and nonadherence—when using community pharmacy-generated medication histories. The team used these algorithms to collaborate with electronic medical record (EMR) and e-prescribing software vendors to integrate problem-oriented “triggers” at the point of prescribing, which organized medication history information for reference during visits.

The team also developed and pre-tested four Web- or DVD-based continuing medical education (CME) training modules that were used to conduct clinician trainings. Module content focused on how to improve geriatric patient-provider communication relating to medication management with the use of technology-based tools.

Physicians who used the e-prescribing application and network to transmit prescriptions to pharmacies were recruited and a two-arm randomized controlled study to test this intervention was conducted. Half the practices received the e-prescribing software, which included triggering based on medication history information. The other half received the software with triggers and were given the opportunity to complete the CME training modules.

Specific Aims:

- Develop geriatric-specific algorithms to identify potential issues with medication management (e.g., polypharmacy, potentially inappropriate medication use, duplicative therapy, and nonadherence) using community pharmacy-generated medication history. **(Achieved)**
- Develop structured, problem-oriented frameworks for organizing medication history information during visits (triggering) for common issues identified by the algorithms developed in the first aim. **(Achieved)**
- Develop and pretest modules to teach clinicians how to improve geriatric patient-provider communication relating to medication management with the use of technology (training). **(Achieved)**
- Test the impact of these interventions on clinician behavior using a randomized controlled trial with two arms: 1) delivery of triggers; and 2) delivery of triggering and training interventions. **(Achieved)**
- Develop “tool-kit” resources and intervention products for use by nonphysician providers in other ambulatory settings (e.g., pharmacists in community pharmacy settings). **(Achieved)**

2011 Activities: During the first 3 years of the project, the research team developed the algorithms and worked with an e-prescribing software developer to learn how medication data were captured and to finalize the specific triggers. An EMR vendor then coded these triggers. By the end of 2010 all participating physicians had the triggers installed in their e-prescribing solution.

Recruitment of physicians from Virginia Commonwealth University was completed in summer 2011. In order to be eligible, physicians were required to use one of two e-prescribing systems and had to provide comprehensive care. In addition, eligibility required that at least 25 percent of each physician’s patient case mix be over 65 years of age, and providers had to be willing to be randomized to one of the intervention arms. A total of 33 doctors were randomized to the two previously developed intervention arms; 14 to algorithms in software, and 19 to algorithms in software and opportunity to complete the CME training modules.

Patient surveys were collected before and after the intervention period to capture patient perceptions of medication-related issues with their providers. Five clinical encounters were audio recorded for each physician. Patient survey data and physician audio data were coded to assess the quality of patient-provider interactions about medications. Data for each medication were coded into themes including general information, knowledge of the drug, discussion of the prescription, and effects of the drug. The coding scheme allowed the team to capture the extent of contribution of each party to medication-related discussions during medical encounters.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were completely on track, and project budget spending was roughly on target. Dr. Lapane’s team utilized a 1-year no-cost extension to ensure adequate time for recruitment, implementation, analysis, and dissemination, and the project was completed in September 2011.

Impact and Findings: Evidence-based treatment algorithms were well received by primary care physicians. Providing alternatives to potentially inappropriate medications would make it easier for physicians to change decisions at the point of prescribing. No changes were found in physician perceptions of e-prescribing or in the patient perceptions of physician communication. Physicians overrode alerts often, and this did not vary by treatment arm.

Target Population: Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Improving Quality through Decision Support for Evidence-Based Pharmacotherapy

Principal Investigator:	Lobach, David, M.D., Ph.D., M.S.
Organization:	Duke University
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017072
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,198,429

Summary: This project developed two interventions to detect evidence-based indications for nine classes of medications based on the presence of diabetes, hypertension, asthma, congestive heart failure, ischemic vascular disease, or stroke. The goal was to improve adherence to evidence-based pharmacotherapies (EBPs) using clinical decision support in the context of a regional health information exchange (HIE). The clinic-directed intervention generated medication management reports displaying a 1-year list of filled prescriptions along with numerical and graphical summaries of adherence and recommendations for missing EBP. Patient-specific reports were sent to primary care clinics a day before a scheduled appointment. The population-oriented intervention sent weekly notices to care managers assigned to patients who appeared to be non-adherent to EBP and had no record of contact with their primary care clinics.

A three-arm randomized controlled clinical trial (RCT) was conducted to evaluate these interventions on adherence to EBP, resource utilization, and cost of care. More than 2,000 Medicaid beneficiaries with at least one priority condition receiving care at one of the 16 study clinics were randomly assigned to usual care, reports alone, or reports plus care manager notices.

Specific Aims:

- Expand the functionality of an existing decision support system in use within a regional HIE network for Medicaid beneficiaries to incorporate evidence-based EBP and to promote medication adherence. **(Achieved)**
- Implement and evaluate the impact of two complementary interventions for medication management on adherence to EBP among Medicaid beneficiaries in ambulatory care settings through a three-arm RCT. **(Achieved)**
- Compare resource utilization and assess the economic attractiveness of the interventions to promote medication adherence and EBP. **(Achieved)**
- Disseminate information regarding the development and impact of the interventions through Web teleconferences, professional meetings, educational lectures, and peer-reviewed journals. **(Achieved)**

2011 Activities: The three-armed medication management RCT was completed at the participating practices in December 2010. At the beginning of 2011, the project team completed the 12-month site monitoring visits to verify report-handling procedures, verify receipt of the medication management reports by providers at the point of care, obtain feedback about provider satisfaction and report utilization, and distribute the 12-month provider satisfaction surveys. Remaining activities in 2011 focused on data collection, data cleaning and preparation, and analysis.

Due to previous years' delays, including unforeseen personnel issues and the technical complexity of the work, the project was behind on the original timeline and used a 1-year no-cost extension. As last self-reported in the AHRQ Research Reporting System, project progress was completely on track, and budget spending was on target. The project ended in August 2011.

Impact and Findings: Neither the reports alone nor the reports and the notices improved adherence to EBP compared to usual care. No improved adherence was detected for any individual class of medication or for any individual condition. The group randomized to receive notices had significantly increased contact with care managers demonstrating the potential to address EBP non-adherence at the population level. Site visits, contextual evaluation, and user surveys suggested that the failure to improve adherence to EBP resulted from insufficient capacity to address medication adherence issues by clinicians in the context of the clinical encounter. The economic analysis found no positive or negative impact on outpatient, inpatient, or emergency department service utilization, or on costs of care.

However, while the general sense was that the delivery of reports was not a significant burden, all groups recognized that report delivery and access would be improved if the reports were available in the information technology systems routinely used by the clinicians. All groups also recognized the potential value of allocating more time and personnel resources to address medication adherence issues after they were identified. Feedback from clinicians was generally positive regarding how the reports uncovered non-adherence and fostered discussions with patients about the importance of adhering to medications as prescribed. In some instances, knowledge of non-adherence influenced clinicians to not increase or change a specific medication because of apparent ineffectiveness, when the actual issue was nonadherence to the medication.

The perceived value of the medication management project intervention led the Medicaid care management program to pay to operationalize the system to keep it functioning after the grant term ended.

Target Population: Chronic Care*, Medicaid

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Using Health Information Technology to Improve Ambulatory Chronic Disease Care

Principal Investigator:	Mehr, David, M.D., M.S.
Organization:	University of Missouri–Columbia
Mechanism:	RFA: HS07-006: Ambulatory and Safety Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017035
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,192,603

Summary: Coordinating fragmented chronic disease care requires new systems to manage information between providers and enhance communication with patients. To improve patient care quality and safety, the Family Medicine and General Internal Medicine practices at the University of Missouri–Columbia (MU) conducted a phased implementation of selected ambulatory care health information technology (IT) systems and functions. This project used a formative (in-process evaluation aimed at improvement) and summative (final overall) evaluation of health IT innovations (described below) designed to improve chronic disease care in the ambulatory primary care practices at MU. These innovations are the result of collaboration between MU clinicians from the Department of Family and Community Medicine and the Cerner Corporation, MU’s Certification Commission for Health Information Technology-certified medical record vendor.

Specific strategies for this project included providing physicians with comparative performance reports in one of three formats (patient panel performance through the EHR, patient panel performance level via email, or individual patient-only performance through the EHR), and providing patients with access to a Web-based interactive software system that features secure messaging, in-home reconciliation of all medications, and use of in-home “smart” diagnostic devices to send patient data directly to the care team.

The project used a multi-method evaluation of health IT innovations, including qualitative interviews, surveys, and analysis of outcome data, designed to enhance the quality of primary care for chronic diseases. The innovations were implemented differently in various practices and with different associated care systems. This variation in care processes provided an extraordinary opportunity to evaluate factors that influence health IT innovations’ effects on performance-based quality improvement, care coordination, and patient self-management.

Specific Aims:

- Evaluate the change in patient care processes and outcomes following introduction of health IT-generated clinician quality performance reports across differences in practices and peers. **(Achieved)**
- Evaluate the effectiveness and changes associated with an interactive Web-based patient interface software system (IQ Health), including in-home medication reconciliation. **(Achieved)**
- Evaluate the use of in-home “smart” diagnostic devices (e.g., blood pressure cuffs, glucometers) connecting patients with their care teams. **(Achieved)**
- Disseminate information regarding the development and impact of the interventions through Web teleconferences, professional meetings, educational lectures, and peer-reviewed journals. **(Achieved)**

2011 Activities: The evaluation of the impact of health IT-generated clinician quality performance reports on diabetes care was completed in 2011. Physicians were randomized to view diabetes performance reports through: 1) the electronic medical record (EMR); 2) a report emailed directly to them; 3) both venues; or 4) not at all. The evaluation compared the patient outcomes based on the type of performance report physicians received. Using qualitative methods, the research team investigated contextual factors, such as local barriers to and facilitators of achieving better performance measure scores, to determine their effect on practice outcomes.

The research team analyzed the data from the evaluation of the use of in-home “smart” diagnostic devices. This included analysis of the impact of the use of in-home devices on patient outcomes and patient’s and provider’s perspectives on use. Seventeen nurses and physicians were interviewed on their perceptions of the smart devices and the transmission of data from the devices to the practice.

The evaluation of the online medication verification process evolved considerably over the course of the project. In the final iteration, participants were asked to review their medication list and generate a message to their provider to notify them of any changes or additions made at the time of a pharmacist home visit. The messages were preferably sent through Healthe (a Web-based patient portal) or regular email. The team then compared information that patients sent with the pharmacist’s “gold standard” evaluation. Additionally, the team evaluated the nature of problems identified (e.g., incorrect listing of medications in the EMR) and the providers’ responses to these messages.

The evaluation of patient and provider expectations and perceptions concerning patient access to a Web portal for secure messaging, medical record review, and appointment scheduling was completed. The Web portal included secure messaging (including prescription requests), medical record review (including medication list and selected laboratory reports), and appointment scheduling. The team analyzed surveys to assess providers’ perceptions and experiences of using IQHealth and on-line surveys of patients who enrolled in IQHealth.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were on track and project spending was on target. The project team used a 1-year no-cost extension to complete the evaluation. This project was completed in August 2011.

Impact and Findings: The diabetes quality performance reports in the format of a dashboard were efficient and improved accuracy. A composite measure of eight diabetes care-quality indicators improved in practices able to access performance information in the electronic record. Practices improving in the second year showed strong leadership, sharing of information, and exhibited adaptive reserve. Initial use of the patient portal was relatively limited but physicians felt better about its impact after use. In-home medication reconciliation is potentially limited by incomplete information from patients and failure to update records by providers. Home monitoring did not improve outcomes, but qualitative findings pointed to important implementation principles.

Target Population: Adults, Chronic Care*, Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ’s priority populations.

Veterans Administration Integrated Medication Manager

Principal Investigator:	Nebeker, Jonathan, M.D.
Organization:	Western Institute for Biomedical Research
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017186
Project Period:	September 2007 – March 2011
AHRQ Funding Amount:	\$594,582

Summary: Computerized clinical decision support (CDS) research often focuses on improving technology, but more research is needed on how CDS can improve patient outcomes in the context of the process of clinical care. The Veterans Administration (VA) has implemented CDS to assist clinicians in reaching quality goals. However, in 2006, 25 percent of hypertensive patients did not reach the performance standards. To better support providers in reaching quality goals for more hypertensive patients, this project funded the development and evaluation of a new health information technology application called the Integrated Medication Manager (IMM). The IMM facilitates clinicians' decisionmaking by helping them consider relevant data when planning patient care. In a departure from the traditional medical record, a major feature of this system is the explicit linking of patient problems, therapies, and goals. This project compared IMM to a standard electronic health record (EHR), thereby generating new knowledge about medication management.

Design guidelines for the IMM were determined by analyzing providers' cognitive processing of information and how and what information is shared among a clinical team. In the first phase of the project, physicians, mid-level providers, and pharmacists were followed during clinical visits. Between patients, they were asked to "think aloud" and describe their thought processes as they worked through decisionmaking for a patient using the EHR. The findings of the observations were shared with the development team to guide them as they refined the IMM software.

The second phase of the project evaluated the IMM software using test cases in simulation studies. The simulation studies provide insight into how providers integrate information and further support evaluation of the IMM.

Specific Aims:

- Identify cognitive components of providers' therapeutic decisionmaking in the field. **(Achieved)**
- Refine and evaluate the IMM using simulation studies. **(Achieved)**

2011 Activities: Fifty-eight providers were recruited to test the IMM through simulations. The IMM organizes information around the core concepts of interventions, observations, and conditions. IMM presents this information in a manner that reduces the cognitive effort to consider data across time, relationships among concepts, and decisionmaking strategies. Standard and VA-specific terminologies and knowledge bases are used to relate concepts and provide the basis for cognitive support and documentation. Participants were asked to review 10 patient cases and write assessments and plans for

each patient. The patient's information was presented in either the new IMM EHR or the generic EHR patterned after the VA's EHR. Participants were randomly assigned to use only one of the programs for the task. Throughout the test cases, the complexity, time horizon, and saliency of the available information differed. The focus disease was more evident or less evident, important information was located further back in time in the patient's medical history or was more recent, and patients' problems were highly complex or less so. Finally, in certain test cases, the provider was interrupted while the complexity of the case was manipulated to see how quickly the provider could recover and return to what s/he was doing.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were mostly on track and project budget spending was roughly on target. During the 6-month no-cost extension period that extended the project-end date to March 2011, the research team continued analysis and developed manuscripts.

Impact and Findings: The translation of the theory "Hollnagel's Contextual Control Model" to analyze clinicians' cognitive processing of information is promising. In this project, it was applied to targeting characteristics that predict higher levels of performance on tasks related to chronic disease management. Close attention to the design of electronic records can improve quality of care by presenting data that supports clinician decisionmaking. With only a few minutes of instruction, providers were significantly faster using the completely unfamiliar medical record. The largest improvement in time was the case of interruptions in considering complex patients. The data is presented such that relationships between data elements are explicit and the provider is not required to link the data as part of his/her analytical process.

Target Population: Adults, Veterans

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

A Partnership for Clinician Electronic Health Record Use and Quality of Care

Principal Investigator:	Pohl, Joanne, Ph.D.
Organization:	Michigan Public Health Institute
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017191
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,184,765

Summary: With the emphasis on health information technology (IT) in ambulatory care deriving from the Health Information Technology for Economic and Clinical Health Act, current use of electronic health records (EHRs) in ambulatory settings is increasing. However, after a health center makes a financial investment in an EHR, barriers—including the need to redesign workflow to incorporate use of the EHR before, during, and after a patient visit—to full and effective use of the system remain. It is especially important for clinical decision support (CDS) systems that these barriers be overcome, because if information is not available at the point-of-care and decisionmaking, health IT cannot improve the quality and outcomes of care.

The Institute for Nursing Centers and the Alliance of Chicago Community Health Services (Alliance) studied the effectiveness of a partnership that shares resources and utilizes a data-driven approach to promote full clinician use of an EHR. Three nurse-managed health centers and three community health centers participated in this effort to improve the quality of preventive care, chronic disease management, and medication management for vulnerable populations. These partners have a record of highly productive research, successful EHR implementation, commitment to data-supported high-quality health care for vulnerable populations, and a history of building and maintaining strong collaborations.

This project addressed one of the key problems in leveraging health IT to support high-quality patient care: despite its potential, CDS is often not used effectively or consistently by clinicians. The design of this project incorporated qualitative investigations and quantitative analyses at both the individual- and the center-level. The critical link between full use of EHR functionality—including CDS features, and clinical performance and quality outcomes—was examined with rigorous statistical methods. The project's EHR product was the integrated General Electric (GE) Centricity Practice Management EHR System with substantial customization of CDS in templates developed by the Alliance. The quality indicators selected were those that the Institute of Medicine has identified as priority areas for improvement and where significant disparities across racial, ethnic, and income groups exist. Qualitative methodology added to the field's understanding of health center leadership and change management required for successful use of EHR.

Specific Aims:

- Study the effectiveness of a partnership that shares resources and uses a data-driven approach to promote full use of an EHR by clinicians in settings that serve vulnerable populations to improve

the quality of care in the areas of preventive care, chronic disease management, and medication management. **(Achieved)**

- Test the links between clinician use of an EHR and quality of preventive care, chronic disease management, and medication safety. **(Achieved)**
- Examine organizational processes in the implementation and full use of an EHR in relationship to care delivery and outcomes. **(Achieved)**

2011 Activities: All study sites were live on the GE Centricity practice management and EHR systems. All sites were also connected to a laboratory interface and the GE data warehouse. A 1-year no-cost extension period was used to complete data collection at all sites. As last self-reported in the AHRQ Research Reporting System, project progress was completely on track and project budget spending was on target. The project was completed in August 2011.

Impact and Findings: Overall quality improvement was shown to occur over time following EHR implementation as measured by structure, process, and outcome metrics. Additionally, when compared to pre-implementation surveys, clinician experience and satisfaction, which dropped during implementation, rebounded after a year. Clinician expectations for EHRs were generally moderated, but overall, clinicians expected and continued to believe in the EHR's positive effect on quality and safety.

Project attempts to measure the depth and quality of EHR use by individual clinicians, and thus measure the association with quality at the clinician level, was hampered by several methodological challenges. It was not possible to track usage of chronic disease management templates directly. The project employed proxy measures that reduced accuracy. In diabetes management, the project was able to infer that the diabetes management template was used if foot exam results were recorded because this was the only place to enter that result. This raises two validity concerns: 1) clinicians not conducting or documenting foot exams may have used the form to document other things; and 2) the diabetes management use metric is indistinguishable from the quality indicator for conducting a foot exam. With regard to hypertension management, the CDS template that was measured was also used to measure cardiovascular disease management. This template did not support the clinical workflow of hypertension management and was not a fair measure of clinician CDS use. The more general metric of creating a clinical note also contains the potential for error. Nevertheless, the validity of the note use measure was supported by a significant correlation to self-reported use of EHR rather than paper.

The project did measure use of the evaluation and management coding advisor, a tool that validates coding of the complexity of the visit for billing. This metric was significantly correlated with relative value unit and full-time equivalent. This finding was expected and supports the argument that EHRs can ensure that providers document and code the complexity of office visits accurately. This feature is important for nurse-managed health centers, which are known to under-code.

The project demonstrated that careful EHR implementation using a model of sustained partnership and focused attention on quality of EHR use by clinicians has a positive impact on quality of care and experience of care by clinicians. However, the resources used to support this model were extensive and, without funding, may not be practical or realistic for most small primary care settings.

Target Population: Chronic Care*, Medically Underserved

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Harnessing Health Information Technology to Prevent Medication-Induced Birth Defects

Principal Investigator:	Schwarz, Eleanor, M.D.
Organization:	University of Pittsburgh at Pittsburgh
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017093
Project Period:	September 2007 – September 2011
AHRQ Funding Amount:	\$1,199,370

Summary: Every year, approximately 150,000 infants—1-3 percent of all births in the United States—are born with some form of physical or neurological birth defect. In its 2000 publication, *Envisioning the National Healthcare Quality Report*, The Institute of Medicine identified prevention of birth defects as one of six national priorities for the health care system. It is estimated that each year, 12 million women in the United States use medications that might increase the risk of birth defects if used during pregnancy. Studies have also shown that the concurrent use of contraception with such medications can prevent associated birth defects. Unfortunately, when prescribing potentially teratogenic medications that may disturb the growth or development of the embryo, clinicians rarely counsel women about contraception. Due to this issue, approximately 6 percent of pregnant women are exposed to medications that may increase the risk of birth defects.

This project developed and evaluated ways that health information technology (IT) may help doctors counsel women about preventing birth defects that could be caused by the use of certain medications. Dr. Schwarz and her project team conducted a series of focus groups with clinicians and patients from academic and community-based practices in order to find out what information regarding birth defects would be most useful to primary care clinicians and their patients. Data from the focus group discussions were used to refine a multi-faceted clinical decision support (CDS) system that was installed within existing electronic medical records (EMRs) in ambulatory care clinics in Pennsylvania.

The impact of the CDS system was evaluated using a cluster-randomized trial. Data from the following sources were collected to inform the study: 1) data abstracted from the EMR when clinicians prescribed teratogenic medications; 2) phone interviews conducted with women prescribed medications by study clinicians; and 3) participating clinicians surveyed about their satisfaction with the CDS they received. The data were used to test the hypotheses that clinicians in the CDS intervention group prescribed fewer teratogenic medications, were more likely to prescribe contraception when prescribing a teratogenic medication, had more patients report satisfaction with the counseling they received, and reported more satisfaction with the CDS they received.

Specific Aims:

- Develop and implement two CDS systems designed to alert ambulatory clinicians to the risk of medication-induced birth defects. **(Achieved)**

- Evaluate the effect of two CDS systems designed to alert ambulatory clinicians to the risk of medication-induced birth defects. **(Achieved)**

2011 Activities: Data analysis and manuscript writing were the primary focuses for the research team. During the analysis of the EMR data, the team found that the CDS system was not turned off at the end of the study and that an extra year of data was available for analysis. Dr. Schwarz received approval from the internal review board to access the additional year of data and the analysis was expanded to include an additional year of CDS alerts. Multi-level models with random effects were developed to address clustering by physician and patient. Patient visits were excluded if the patient saw physicians from both the intervention and control groups. Analyses were adjusted for visit characteristics to control for baseline imbalances. Additional analyses were conducted regarding provider perceptions of counseling patients on contraceptives as well as patient and provider perceptions of CDS.

Dr. Schwarz used a 1-year no cost-extension to allow time to analyze the additional year of data that was generated from the CDS system. As last self-reported in the AHRQ Research Reporting System, project progress and activities was mostly on track, and the project budget spending was roughly on target. The project was completed in August 2011.

Impact and Findings: Three types of barriers to contraceptive counseling were identified during the clinician focus groups: patient, provider, and health system barriers. At the provider level, barriers included limited awareness of pregnancy risk; lack of knowledge, training, or comfort providing contraception; beliefs about certain contraceptive methods; a perceived patient responsibility for initiating discussions; a need for skilled personnel to place certain contraceptive methods; and a lack of communication with subspecialists. Health system-level challenges regarding contraceptive counseling included lack of insurance or family planning coverage; limits on provider time; limited access to providers trained to fit or insert contraceptive devices; competing medical priorities for patients and providers; visit type; case mix; and lack of a clinical care system to remind providers.

Evaluation of the CDS system indicated that multi-faceted CDS and streamlined clinical alerts were both associated with slight increases in family planning services, however there was no difference in the relative improvement between the two arms ($p=0.87$). The multi-faceted CDS group reported a greater increase in the number of times they counseled women about the risks of medication use during pregnancy. The streamlined CDS group reported greater clinician satisfaction with CDS usability ($p=0.03$). Of note, to avoid alert fatigue, the CDS system was designed such that providers were alerted only once after prescribing a potentially teratogenic medication. An unintended consequence of this design was identified in the analysis; 13 percent of providers responded to the alerts by prescribing an alternate medication that was also a potentially teratogenic medication, however, by design a second alert was not generated in these situations. Overall, the CDS showed potential to improve provision of family planning services but further system refinements are necessary.

Target Population: Women*: Pregnancy

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Synthesis and Dissemination

* This target population is one of AHRQ's priority populations.

Improving Laboratory Monitoring in Community Practices: A Randomized Trial

Principal Investigator:	Simon, Steven, M.D., M.P.H.
Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017201
Project Period:	September 2007 – February 2012
AHRQ Funding Amount:	\$990,640

Summary: Medication errors and preventable adverse drug events (ADEs) occur commonly among patients in the ambulatory setting, and constitute an important target for patient safety and quality improvement. Laboratory monitoring to ensure the safety and effectiveness of drug therapy and the timely management of abnormal results of laboratory testing have been increasingly recognized as important areas for improving patient safety in ambulatory care. Promising interventions have been developed for practices affiliated with hospitals and integrated delivery systems, but efforts have not adequately reached physicians practicing solo or in small community practices.

The overall aim of the project is the assessment of clinical decision support (CDS) point-of-care alerts to address barriers to and facilitators of laboratory monitoring and a results-management system to improve timeliness of communication of laboratory results to patients. The study uses eClinicalWorks, a widely used and commercially available electronic health record (EHR). Therefore, findings may be generalized to other settings using the same EHR. The project began with a qualitative analysis of the barriers and facilitators of laboratory monitoring and timely followup of abnormal results among clinicians in ambulatory primary care practices. This information was used to develop, implement, and evaluate computerized alerts to facilitate indicated laboratory monitoring of medications at initiation or continuation of therapy. Originally, the study team had planned to design and implement an enhanced results management system. However, eClinicalWorks had developed a similar system so the project team decided to evaluate the system at three clinics where it had been implemented recently.

Specific Aims:

- Identify barriers to and facilitators of laboratory monitoring and timely followup of abnormal results. **(Achieved)**
- Design, implement, and evaluate CDS (point-of-care alerts) for laboratory monitoring in a widely used, commercially available EHR that addresses barriers to and facilitators of laboratory monitoring. **(Ongoing)**
- Design, implement, and evaluate a results management system to efficiently handle abnormal laboratory test results in ambulatory care. **(Retired)**
- Develop a detailed dissemination guide and widely distribute it to other practices and communities interested in implementing similar interventions. **(Ongoing)**

2011 Activities: This project was conceived as two clustered randomized controlled trials —first the computerized point-of-care alerts, then the results management system. Due to delays and ultimately changing priorities of the original implementing partner, the project team partnered with other collaborators and changes were made to the project plan. Dr. Simon is working closely in consultation with the Agency for Healthcare Research and Quality (AHRQ) to implement these changes.

The research team established a partnership with Take Care New York, an organization that implemented eClinicalWorks at primary care practices in New York City. With the support of eClinicalWorks, the research team implemented the newly developed alerts to evaluate laboratory monitoring of medications. Eleven practices with 15 providers were recruited and demographic data were collected. Six clinics were randomized to the intervention arm and five to the control arm. Significant resources were invested in mapping the laboratory tests at each clinic. Focus groups were conducted with end users of eClinicalWorks. The analysis plan for the study includes a pre-implementation analysis that will look at correlates of laboratory monitoring errors before and after implementation.

As previously mentioned, Dr. Simon initially proposed to develop and implement a results-management system. However, eClinicalWorks simultaneously developed a plan to expand its EHR to include a patient portal with similar functionality to what the project team had proposed. As a result, the project shifted to the evaluation of the patient portal. The study team partnered with three mid-sized, multi-provider clinics that were early adopters of the patient portal. A pre-post study design is being used to evaluate the difference between the proportion of patients notified of laboratory results and the time to notification. Primary notification is defined as a sent letter, telephone contact, followup visit, or results sent via the patient portal. Secondary notification is defined as a followup, prescription, or referral to a specialist. The research team convened an expert panel to adapt existing inpatient guidelines for the notification of test results in an ambulatory setting. Additionally, a data extraction tool was developed to validate patient notification for a random subsample of patients at each clinic using the EHR.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget funds are slightly underspent to allocate funds for the remainder of the no-cost extension (NCE). During the 6-month NCE period, the research team will focus on data collection and analysis.

Preliminary Impact and Findings: Focus group participants viewed laboratory monitoring as a critical, time-consuming task integral to their practice. Most believed they commit few laboratory monitoring errors and were surprised at the error rates reported in the literature. They listed various barriers to monitoring, including not knowing which physician was responsible for laboratory monitoring, uncertainty regarding the necessity of monitoring, lack of reminders, and patient non-adherence. The primary facilitator of monitoring was ordering laboratory tests while the patient was in the office. Primary care providers felt more strongly than specialists that computerized alerts could improve laboratory monitoring. Participants wanted to individualize alerts for their practices and warned that alerts must not interrupt workflow. Physicians in community practices recognized the potential of computerized alerts to enhance their monitoring protocols for some medications. Interventions to improve laboratory monitoring should address physician workflow issues and increase patient awareness of the importance of fulfilling recommended therapeutic monitoring to prevent ADEs. At the request of the 11 study practices, eClinicalWorks intends to maintain and support the laboratory monitoring alerts beyond this project.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Using Information Technology to Provide Measurement Based Care for Chronic Illness

Principal Investigator:	Trivedi, Madhukar, M.D.
Organization:	University of Texas SW Medical Center – Dallas
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017189
Project Period:	September 2007 – February 2011
AHRQ Funding Amount:	\$1,196,703

Summary: Depression is the most common mental health cause for disability, and treatment should consider the chronic nature of the disorder. Current routine practice in psychiatric settings does not depend on a systematic measurement-based approach to treatment planning but on clinical judgment. Despite the development of effective treatments over the last 30 years, evidence from practice settings continues to show inadequate antidepressant medication treatment in dosage and duration. This project applied expertise in algorithm and guideline implementation to the development of a clinical decision support system (CDSS) integrated with an electronic health record (EHR) to disseminate the principles of evidence-based treatment for depression in large systems of care.

The project focused on the use of measurement-based care (MBC) to improve the quality of care for patients with major depressive disorder (MDD). The EHR-CDSS program facilitated MBC to improve medication management for patients with MDD by using information technology (IT) to ensure that clinicians monitored three critical response domains (symptom severity, side-effect burden, and treatment adherence) using standardized measures. The IT system also provided decision support during each medication treatment phase and helped prevent medication errors.

This project was a collaboration between the University of Texas Southwestern Medical Center and the Centerstone Community Mental Health Center, Inc. (Centerstone), which provides behavioral health services throughout Tennessee. The first phase of the project was primarily devoted to customizing the CDSS to accommodate Centerstone's specific needs and integrating CDSS into Centerstone's EHR, CenterNet. The objective of the second phase was to test the effectiveness of the EHR-CDSS to increase clinicians' use of MBC principles in medication management for patients with MDD.

This project involved two research studies to evaluate effectiveness of the EHR-CDSS. The first study was a comprehensive, system-wide evaluation that included clinicians using the EHR-CDSS and their MDD patients who required a treatment change, either in medication or in dosage. The second study was an in-depth evaluation of the impact of the EHR-CDSS on a limited sample of physicians and their patients, directly assessing the use of MBC using a pre-post test design.

Specific Aims:

- Integrate a CDSS that facilitates MBC with physician needs and the EHR at Centerstone. **(Achieved)**

- Evaluate EHR-CDSS's successful promotion of MBC in improving medication management. **(Achieved)**

2011 Activities: The 6-month no-cost extension period ended February 2011. All project activities were completed.

Impact and Findings: A needs assessment was conducted with representative Centerstone clinical staff members to determine how best to integrate the CDSS and EHR. Their primary concern was the increased time burden, in both the length and number of treatment visits. Based on prior reports, the research team expected that providing MBC would initially require more time, but once the system was established, the increased visit time would primarily involve the time the patient needed to complete the self-report assessments. Data showed that while patients in the algorithm arm of the trial initially were seen at a higher frequency, the total number of visits over a year were similar in both arms of the trial.

The first study was designed to provide a systematic evaluation of changes in treatment patterns in the Centerstone system before and after implementation of EHR-CDSS. There was a significant difference in both the total number of visits and the patterns of treatment visits. Additional analyses that explore differences based on decision support usages, length of time between visits, and the utilization of MBC assessments during treatment visits are ongoing.

Target Population: Adults, Chronic Care*, Mental Health/Depression

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Electronic Prescribing and Decision Support to Improve Rural Primary Care Quality

Principal Investigator:	Veline, James, M.S., M.A.
Organization:	Avera Health
Mechanism:	RFA: HS07-006: Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health Information Technology (IQHIT)
Grant Number:	R18 HS 017149
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$1,181,866

Summary: Poor patient compliance with prescribed medications can adversely affect treatment outcomes. The compliance rate for patients receiving long-term treatment for chronic conditions, such as hypertension, is estimated to be as low as 50 percent. The introduction of electronic prescribing (e-prescribing) systems has the potential to greatly improve the accuracy and efficiency of pharmaceutical treatments. This project examined whether, in rural ambulatory care settings, the use of an e-prescribing system with clinical decision support for medication management increases patient prescription adherence, improves the medication management process, and improves health outcomes in hypertensive patients. As part of its overall Avera HealthCARE™ Initiative, the South Dakota-based health system worked with 28 hospitals and 116 clinics to implement a regional electronic medical record (EMR). The technology package included advanced e-prescribing software, DrFirst Rcopia, that enables physicians to track the fill status of prescribed medications, and provides interaction alerts, formulary listings, dosing options, patient medication history, and printed wallet-size medication lists. The research team examined the impact of the technology on the medication management for patients with hypertension in nine rural or frontier primary care facilities. The project focused on two health information technology (IT) systems: 1) DrFirst Rcopia electronic prescription management system as a stand-alone product; and 2) DrFirst Rcopia integrated within the Meditech/LSS Data Systems Medical EMR and Practice Management Suite, the EMR system being implemented by Avera Health in the ambulatory setting. This EMR includes Zynx Health decision support technology.

The project took advantage of staged implementation, first gathering baseline measures and then tracking clinics that are using e-prescribing as a stand-alone tool before moving to an EMR, and clinics that are moving directly to an EMR with integrated e-prescribing. Medical claims data and the e-prescribing patient-fill histories were used to determine whether patient prescription adherence improved, as measured by blood pressure levels and changes in treatment for patients with blood pressure higher than one hundred forty over ninety. This study was based on the observation of a “natural” process of disseminating and implementing a set of health IT innovations. As such, the experiment can be characterized as a quasi-experimental design with opportunistic, nonrandom assignment of clinics to the experimental condition.

Specific Aims:

- Improve the rate of adherence to prescribed medications among patients with hypertension in rural communities. **(Achieved)**

- Improve adherence to prescribed medications among patients with hypertension through use of e-prescribing tools in rural care settings. **(Achieved)**
- Improve health outcomes for patients with hypertension in rural communities through the use of e-prescribing and associated clinical decision support tools. **(Achieved)**
- Enhance patient and provider satisfaction with the e-prescribing tool. **(Achieved)**
- Overcome barriers to successful adoption of e-prescribing. **(Achieved)**

2011 Activities: A 1-year no-cost extension provided time for the project team to complete data collection activities and the program evaluator and biostatistician to complete the analysis. The team administered the second round of provider satisfaction interviews and patient satisfaction with care surveys. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. All activities were completed when the project ended in August 2011.

Impact and Findings: The results did not indicate that the implementation of stand-alone e-prescribing had an effect on the control of hypertension since the proportion of patients with control of blood pressure dropped slightly after implementation. However, after the EMR implementation occurred, there was an increase in the proportion of patients with control of hypertension compared with stand-alone e-prescribing. In addition, the proportion of patients with control of hypertension after EMR implementation was higher than at the baseline, prior to e-prescribing. There were a similar number of prescriptions in both the stand-alone system and after compliance and adherence messaging were added. The first-fill rates in these first two implementations were substantially higher than during the EMR implementation.

The patient survey results were similar across the three study phases. There was a slight downward trend in the level of satisfaction on hypertension treatment after implementation of the stand-alone e-prescribing system and after implementation of the EMR. However, there was an increased level of satisfaction with hypertension medications after both implementations.

A total of 149 educational interventions were recorded for patients with hypertension. A total of 26 patients were identified with hypertension pre- and post-intervention. There did not appear to be a significant effect on blood pressure control, although data on educational interventions and the number of blood pressure readings pre- and post-intervention were limited.

Provider perceptions were more positive when compared to the baseline pre-implementation for both the stand-alone e-prescribing and the EMR implementations. Patient adherence increased, as reflected in the medication possession ratios.

There was a small but consistent pattern across the three study phases, which showed reduced use of brand-name medications and increased use of multisource or generic medications. Changes in medication availability during the time period of the study from additional multisource medication options for prescribers may have influenced the results.

The clinic operating costs trended down for the first three phases, with an increase in cost for phase four during the EMR implementation at most of the clinical sites.

Target Population: Adults, Chronic Care*, Hypertension, Rural Health*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Chronic Mental Health: Improving Outcomes Through Ambulatory Care Coordination

Principal Investigator:	Baker, Wende, M.Ed.
Organization:	Southeast Nebraska Behavioral Health Information Network, Inc.
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017838
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,871

Summary: Without electronic communication, behavioral health providers cannot follow the full treatment path of patients with mental health issues as they move between various providers in urban and rural outpatient settings, mental health hospitals, protective custody, and crisis mental health facilities. This project explores how the exchange of health information between rural and urban providers in the behavioral health field can improve ambulatory patient care coordination and safety across treatment settings. Specifically, the project examines provider barriers to technology acceptance in the behavioral health setting, behavioral health care technology acceptance and adoption, and the effects of a health information exchange (HIE) on clinical outcomes.

The development and implementation of a regional HIE in southeast Nebraska will decrease the time it takes for providers to access comprehensive and accurate information, thus creating better access to patient information between and among the provider care team serving an individual with mental illness. This, in turn, will improve continuity of care by providing an electronic link between the multiple service settings that serve Nebraska residents. The provision of basic electronic information to coordinate patient care between behavioral health providers, rural hospitals, and the emergency behavioral health system will improve the long-term health outcomes of individuals with serious, persistent mental illness.

During the first phase of the project, the Electronic Behavioral Health Information Network (eBHIN) team issued a request for proposals, researched vendor qualifications, and ultimately selected products from NextGen Healthcare. At the same time, the research team began to design the HIE and conducted a behavioral health provider survey focused on technology acceptance. In the second phase of the project, the team developed the HIE infrastructure, equipped provider offices with new or updated technology, and provided training to participating providers. In phase three, the team will implement the HIE in 11 organizations at 15 practice settings. Once the environment is established, data will be collected to evaluate how timely access to accurate information might improve the quality of care for those experiencing a behavioral health crisis and who have an immediate need for entrance into the emergency behavioral health care system.

Specific Aims:

- Identify provider barriers to technology acceptance. **(Ongoing)**
- Implement an HIE among three major behavioral health provider facilities. **(Ongoing)**
- Collect data on how timely access to accurate information relates to quality of care. **(Upcoming)**

2011 Activities: System design activities focused on technical and procedural infrastructure development, security compliance, system implementation, and training. Development of the HIE customization from NextGen continued into 2012; however, the study team has been deploying other parts of the system in the interim so that providers will have records to share once the HIE is implemented. The team worked closely with Magellan Community Health and the Nebraska Administrative Services Organization to develop a file transfer process based on clear technical requirements. They also successfully completed a data center security audit. No high vulnerabilities were found. Three medium vulnerabilities were found and addressed immediately. Low vulnerability areas will be addressed through policies and procedures. The team is developing specifications and procedures for secure direct messaging between the NextGen system and the HIE application. By the end of July 2011, the system was live for data entry and data upload at 15 practice sites, including data entry of the shared record, data aggregation, and upload to Magellan. By the end of December 2011, there were 10,000 records in the system. In addition to significant site training efforts, Dr. Baker and her team worked closely on connecting sites to the data center and providing training on the upload process.

Research activities focused on manuscript development, including the dissemination of findings from a statewide survey focused on benefits and barriers to electronic sharing of client information that was sent to all practicing behavioral health providers in Nebraska. An article summarizing these findings was accepted for publication by the *Journal of the American Medical Informatics Association*. An article, [Electronic health records: eliciting behavioral health providers' beliefs](#), presenting findings from interviews with 32 behavioral health providers regarding their beliefs about HIE was published in the *Community Mental Health Journal*. The research team is also preparing to begin two implementation studies that will include surveys of end-users, using the technology adoption model to explore intention-to-use, and looking at actual usage patterns.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track. The project budget funds are significantly underspent, as the project team is reserving funds for the impact study. Due to initial project delays in 2009 and the unanticipated amount of time to develop some specifications in 2010, the team is using a 1-year no-cost extension to ensure adequate time for the impact study and subsequent analysis and manuscript preparation.

Preliminary Impact and Findings: Analysis of the statewide survey showed that a majority (67 percent) of providers were positive about the impact of HIE, while the remainder (33 percent) were negative. Most behavioral health providers are supportive of HIE; however, adoption and use may continue to lag behind that of medical providers due to perceived cost and time burdens and concerns about access to and vulnerability of information.

Themes identified through interviews with behavioral health providers included quality of care, privacy and security, and delivery of services. Benefits to quality of care were mentioned by 100 percent of the providers; barriers by 59 percent of providers. Barriers involving privacy and security concerns were mentioned by 100 percent of providers; benefits by 22 percent. Barriers to delivery of services were mentioned by 97 percent of providers; benefits by 66 percent. Eighty-one percent of providers expressed overall positive support for electronic behavioral health records.

Target Population: Adults, Chronic Care*, Mental Health/Depression

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Evaluation of Effectiveness of a Health Information Technology-Based Care Transition Information Transfer System

Principal Investigator:	Ciemins, Elizabeth, Ph.D.
Organization:	Billings Clinic Foundation
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017864
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,155,371

Summary: This project seeks to improve the coordination of care for patients with two or more chronic conditions who are discharged from a hospital to a rural primary care clinic. The project team has developed and implemented a Care Transition Information Transfer (CTIT) system for all Billings Clinic Hospital discharged patients and followup providers, with a particular focus on those living in rural communities. The CTIT system will pull patient data from the Billings Clinic integrated electronic health record (EHR).

Primary care clinics within the Billings Clinic integrated health system are notified of their discharged patients directly through the EHR. Primary care clinics outside the system receive notifications by e fax or email, providing basic data on the recent hospitalization, followup appointments, and medications. These providers are prompted to access more complete medical information by connecting through a Web-based portal to the hospital's EHR. The system provides patients and their primary care providers (PCPs) with discharge information, including a patient-friendly medication list, as well as information about followup visits, laboratory testing and results, and operative reports.

Project staff are conducting a prospective study to evaluate whether development and implementation of the CTIT system has improved patient and rural provider satisfaction with the hospital discharge process, and to measure system efficiency and process outcomes, and patient clinical outcomes. Patient clinical outcomes include patient adherence to medication instructions after discharge, patient receipt of reconciled medication lists, hospital readmission rates, ambulatory followup visits, and utilization of emergent care services. Clinical outcome data have been collected at three data points: baseline data were collected on 400 patients between October 2008 and August 2009, and post-intervention data were collected between April and December 2010 (401 patients), and from August 2011 to January 2012 (295 patients).

Specific Aims:

- Develop a health information technology-based CTIT system. **(Achieved)**
- Evaluate the effects of the CTIT system on:
 - Clinical and systems-level outcomes. **(Ongoing)**
 - System efficiency. **(Ongoing)**
 - Satisfaction with care transitions among rural PCPs. **(Ongoing)**

- Patient satisfaction with care transitions. **(Ongoing)**
- Timely communication of patient information. **(Ongoing)**

2011 Activities: During the first quarter of 2011, the research team completed data collection for the intervention period. The final medication reviews, to verify the accuracy of patient-friendly medication lists distributed at discharge and EHR medication lists at time of telephone call were conducted via telephone and chart review by research nurses and pharmacists. A total of 400 chart reviews were completed by registered nurses who have specific experience in medication assessment. In addition, 400 patient satisfaction surveys were sent and 154 returned, and 400 post-intervention-period telephone interviews were completed.

In July 2011, the project went live with the distribution of the Clinical Summary Form in the Housewide Depart (HWD) process. The HWD is a nurse-driven checklist that includes both patient and provider discharge information. This means that when any patient with a listed PCP is discharged from the hospital, the PCP will be notified that his/her patient has been in the hospital. Prior to this, only patients discharged by a participating hospital had a note sent to their PCP. This represents an increase from reaching 15 to 20 percent of discharged patients to approximately 80 percent.

The post-intervention round of data collection began in September 2011, and will continue into early 2012. So far, 194 patients have been called; therefore, Dr. Ciemins and her research team reached the goal of conducting 50 calls per month. The purpose of these calls is to assess followup health care utilization, education received, medication reconciliation, and medication correctness (i.e., whether medications are being taken correctly). The post-intervention round of expert medication reviews is also on track, and by December 2011, reviews had been completed on 68 of the 80 patients who had been targeted for this review.

In fall 2011, Dr. Ciemins embarked on a new collaborative effort with the Community Care Transitions Project (CCTP), led by the Quality Improvement Organization for Montana (Mountain Pacific Quality Health). CCTP is particularly interested in Dr. Ciemins' research in the area of transitions to non-hospital care settings because Billings Clinic Hospital is widely considered to be one of the most progressive hospitals in the region in terms of care transitions. CCTP is organizing community organizations, including assisted living and nursing homes throughout the area, and looking at transitions to other care settings in addition to patients' homes. The Billings Clinic Center for Clinical Translational Research is leading activities to identify measures and outcomes of care transitions.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is on target. Dr. Ciemins is using a 1-year no-cost extension to ensure adequate time to complete data collection, medication reviews, and data analysis.

Preliminary Impact and Findings: A total of 150 PCPs completed surveys on their satisfaction with the discharge process at baseline and following the intervention period. Post-intervention results showed that 63 percent of providers found the discharge process to be efficient and reliable, resulting in quality patient care, compared with 38 percent at baseline. Substantial improvements were also shown when providers were asked whether information was sufficient and timely, and when asked about whether they and their patients were provided with reconciled patient medication lists.

Target Population: Adults, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Enhancing Complex Care Through an Integrated Care Coordination Information System

Principal Investigator:	Dorr, David, M.D., M.S.
Organization:	Oregon Health and Science University
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017832
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,155,147

Summary: Patients with chronic illnesses are at risk for complications due to a lack of coordination and quality in a fragmented health care system. This project is investigating whether care for patients with complex needs can be improved by implementing an integrated care coordination information system (ICCIS) developed by the Oregon Health and Science University. ICCIS incorporates population management techniques, patient-centered goals, quality measures, and clinical reminders to support clinical care teams and patient self-management. The three study objectives are to: 1) understand whether ICCIS can be implemented among diverse clinics using certified electronic health records (EHRs) and existing standards; 2) assess whether the functions in the ICCIS can be used by the clinics; and 3) evaluate whether these system changes lead to improved patient outcomes.

Using a randomized, controlled trial, Dr. Dorr and his team are examining whether six participating clinics (three inner-city, three rural) can use health information technology (IT) to monitor and deliver care for high-risk patients with a care coordination model (Arm 1), or quality performance model (Arm 2). The team is evaluating how well care coordination functions are used at the clinics. Measures include indicators of patient engagement, clinic-level quality of care, clinic-level process, and patient health outcomes.

Specific Aims:

- Implement the Care Management Plus and ICCIS models. **(Achieved)**
- Perform a cluster randomized, controlled trial in six clinics on the ability to use the IT functions to monitor and deliver care to high-risk patients through a care coordination (Arm 1) or a quality performance model (Arm 2). **(Ongoing)**
- Assess the implementation. **(Ongoing)**
- Understand and disseminate the outcome, benefits, challenges, and unintended consequences from use of these functions for patients and the system. **(Ongoing)**

2011 Activities: Developing the second version of ICCIS was the project team's major focus in 2011. The following system refinements were implemented in ICCIS Version Two: 1) passwords were synched across several systems to simplify password management; 2) patients without a clinic visit in 3 years are now automatically inactivated to improve the accuracy of reporting; 3) the rule base that generates appointments with care managers was modified to allow care managers enhanced flexibility for task

coordination; and 4) software was modified to allow ICCIS to better integrate with information systems in other clinics. From the end-user perspective, Version Two of ICCIS increased the speed of loading quality measure reports from approximately 90 to 10 seconds. As a result, clinician work flow improved, and the reports are easier to use on a regular basis or on an as needed basis. The changes also improved the usability of the interface and integration of data sources, which minimizes double entry between the EHR and ICCIS.

The collection of patient-level data from ICCIS continued in 2011. A post-study survey and an interview guide were developed and tested. The survey was administered in-person to clinicians and office managers at each of the six sites. Followup interviews with the same clinic staff are nearly complete. The surveys and interviews will be analyzed to quantitatively and qualitatively assess issues such as the aspects of care management that were most useful, awareness of reimbursement related to care management, and level of user-friendliness of the system design.

The project is using a 1-year no-cost extension to complete the project. As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project budget spending is on target.

Preliminary Impact and Findings: Of the 65,615 patients followed by the six clinics, 13,852 were seen twice during the study period and were therefore eligible for the study. Among eligible patients, 51 percent were over the age of 50, and 15 percent were preselected as having a high risk of hospitalization. Baseline characteristics of the high-risk group did not vary across clinics. Of those eligible, 2,087 were enrolled and actively followed by care managers. In the care coordination arm, clinics received reimbursement for completing care management activities. For this arm, the number of completed care management activities was three times higher than for the quality improvement arm. In the quality improvement arm, clinics received reimbursement for meeting quality measure benchmarks. Overall, this arm demonstrated a doubling of achieved quality measures and achieved more consecutive improvements than the care coordination arm. Of the two study arms, fee-for-service care coordination reimbursement was more effective. Results, as available, will be stored on the project Web site: www.caremanagementplus.org.

Dr. Dorr reports that end-user feedback was very positive and that five of the six clinics will continue to use ICCIS beyond the end of the project. Additionally, the project has generated a lot of interest from other clinics, many of which have approached Dr. Dorr to express their interest in using ICCIS.

Target Population: Adults, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

An Electronic Personal Health Record for Mental Health Consumers

Principal Investigator:	Druss, Benjamin, M.D., M.P.H.
Organization:	Emory University
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017829
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,379

Summary: Due to the complex health care needs and fragmentation of care faced by individuals with mental health disorders, these patients may benefit from the use of electronic personal health records (PHRs). PHRs can shift ownership and locus of health records, make them less likely to be scattered across multiple providers, and more likely to be longitudinal and patient-centered. However, currently available PHRs typically lack mental health-related modules.

To address this gap, Dr. Druss and his research team adapted an existing PHR to better meet the needs of patients with serious mental illness and one or more co-morbid medical conditions. The investigators are evaluating the impact of this modified mental health PHR (MH-PHR) in a 12-month, randomized controlled trial. During the first 6 months of the intervention phase, a clinical care nurse helps patients access and maintain use of their MH-PHR; during the second 6 months, patients continue use without support. A control group receives education materials about health and self-management. The investigators are evaluating the impact of the MH-PHR on patient self-activation and provider effectiveness in managing mental health by conducting chart reviews and interviews with patients.

Specific Aims:

- Develop a MH-PHR for mental health consumers. **(Achieved)**
- Implement a randomized trial of the MH-PHR. **(Achieved)**
- Evaluate impact of the MH-PHR. **(Ongoing)**
- Disseminate results. **(Ongoing)**

2011 Activities: Activities focused on data collection as the randomized controlled trial was ongoing during the year. Subjects participated in the intervention for 12 months with the final participant completing the trial in September 2011. By the end of the year, all followup interviews had been completed and the chart reviews were ongoing. Due to early project delays with the development of the software module and delays in gaining permission to access patient charts, the project is using a 1-year no-cost extension (NCE) to complete data collection, data analysis, and manuscript preparation.

The project team has also developed a Twitter account and a Facebook page; both are private and invitation only, where study participants can share information, such as relevant health classes and other education materials, with each other. In addition, the team has presented on the study and the interventions at

several meetings, including a poster presentation at the 14th Annual ICSI/IHI Colloquium on Health Care Transformation in May. There has been a lot of interest on the project in that the use of advanced technological tools is feasible in low-literacy, underserved populations.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track according to the revised timeline based on the NCE, and project budget spending is on target.

Preliminary Impact and Findings: Data collection and analysis are currently ongoing. There are no project findings to date.

Target Population: Adults, Chronic Care*, Low-SES/Low Income*, Medicaid, Mental Health/Depression, Racial or Ethnic Minorities*, Safety Net, Uninsured

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Improving Care Transitions for Complex Patients through Decision Support

Principal Investigator:	Eisenstein, Eric, D.B.A.
Organization:	Duke University
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017795
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,198,254

Summary: The care of patients with complex health care needs is often fragmented because patients receive care from multiple providers in disparate locations and because information related to this care is often not transmitted between providers or locations. Inadequate inter-provider communication and care coordination significantly lowers care quality and compromises patient safety. This project seeks to improve outcomes, quality, and coordination of care for patients with complex health care needs by facilitating the availability of information following three types of care transitions into ambulatory care: hospital discharge, emergency department (ED) discharge, and specialty care referrals.

The project built upon the Community-Oriented Approach to Coordinated Healthcare, an existing regional health information exchange (HIE) network that connects providers serving Medicaid beneficiaries in rural and urban North Carolina. The project team implemented an open-source clinical decision support (CDS) application called ClinicaCDS to detect care transitions and produce and send care event summary reports to patients, patients' assigned medical homes, and care managers. These intervention notices support traditional clinic-based models of care as well as models that incorporate population health management and cross-disciplinary teams.

The impact of the interventions are currently being evaluated by randomizing patients with complex health care needs by family unit into one of three arms: 1) information on care transitions is sent to patients and clinic-based caregivers; 2) information on care transitions is sent to patients, clinic-based caregivers, and care managers; and 3) no information is sent (i.e., usual care). As a primary outcome measure, the research team used the overall rate of ED use. In addition, the economic impact of the intervention will be measured relative to usual care. Information-augmented care transitions between sites are expected to improve care coordination, quality, and appropriateness of care.

Specific Aims:

- Enhance the existing HIE network and decision support tool. **(Achieved)**
- Implement and evaluate the intervention. **(Ongoing)**
- Conduct the economic attractiveness assessment. **(Upcoming)**
- Disseminate the findings. **(Upcoming)**

2011 Activities: The CDS system and interventions were finished and tested in February 2011. The study went live in March 2011. Data collection is ongoing for the evaluation and will be complete when the randomized controlled trial (RCT) ends in March 2012. The focus going forward until the end of the study period will be to conduct the clinic site visits and continue to provide support for the project and the interventions. By the end of 2011, the 1-, 3-, and 6-month site visits were completed and the coordination team had begun initiation of the 9-month site visits. As part of these visits, the contextual evaluations are being conducted with clinic staff personnel as well as clinic care providers. This contact with the sites helps the project team to informally evaluate the system, hear the sites' concerns, and identify ways to increase the benefit of the interventions and decrease the information overload to sites. For example, the project team customized the sending of interventions (care event summaries and requests for information) based on the location (e.g., hospital of service) and type (e.g., ED, hospital, specialty encounters) of care event.

The research team continued telephone surveys of randomly-selected patients to confirm receipt of the letters and to ask whether they took the letters to their followup appointments with their primary care clinicians. They modified their patient contact protocol so that patients are called a week rather than a month after an event to lessen the impact of elapsed time on patient recall. Finally, the research team, with the assistance of clinicians, has continued to work on their patient education brochures, which will be completed in January 2012 after the required departmental and State Medicaid program review process.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track. The project budget funds are slightly underspent due to the conservation of funds to complete the RCT. The project team is using a 1-year no-cost extension to ensure adequate time for the RCT, which was delayed due to previous years' delays in programming the interventions and subsequent analysis and manuscript preparation. In addition, personnel change resulted in one of the co-investigators taking on the role of project principal investigator.

Preliminary Impact and Findings: Evaluation outcomes will not be available until the RCT is complete. However, during the site monitoring visits, clinics have reported that they are pleased with the intervention and feel the reports can be integrated into their workflow with minimal disruption.

Target Population: Chronic Care*, Medicaid

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Improving Medication Management Practices and Care Transitions Through Technology

Principal Investigator:	Feldman, Penny, Ph.D.
Organization:	Visiting Nurse Service of New York
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017837
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,998

Summary: The overall aims of this project are to examine the relative effectiveness and cost-effectiveness of a health information technology (IT) intervention designed to facilitate high-quality care transitions to home health care. The project developed a medication management system intended to improve clinician practice and enhance patient engagements by identifying patients with complex medication regimens, providing electronic decision support for clinicians, and providing supplementary information to patients. The intervention being tested uses an automated algorithm to identify high-risk patients and send an email alert to the home health nurse shortly after the patient’s admission to home care. It also provides the nurse with medication decisionmaking support, including high-risk medication management recommendations that are integrated into the clinician’s visit documentation system and the patient’s electronic health record. The patient receives educational materials as part of the intervention. The health IT system will be evaluated by comparing the intervention arm to the usual care group in a randomized controlled trial. This project is an extension of the existing Visiting Nurse Service of New York health IT system and uses many of the features that the home health nurses regularly use.

Specific Aims:

- Examine the relative effect of the intervention on workflow and medication management practices of home health care nurses. **(Ongoing)**
- Examine the relative effect of the intervention on the outcomes and service use of patients in the respective intervention groups. **(Ongoing)**
- Estimate the costs associated with the intervention and subsequent care and compare these costs relative to usual care. **(Ongoing)**

2011 Activities: Implementation of the intervention began in February 2010. In 2011, an automated process was set up to calculate a medication regimen complexity index score using electronic medication information that is collected as part of usual care. The nurses of eligible patients were randomized to the usual care group and intervention group on a rolling basis at a two-to-one ratio. Once randomized, the study arm assignment did not change, and all eligible patients of a particular nurse were included in the same study arm as the nurse’s randomization assignment. A subsample of eligible patients whose nurses were randomized into the study was recruited to complete in-home surveys that provided additional information on process of care and outcomes.

The analysis team focused on obtaining data, data cleaning, and data analysis. Two sets of analyses were planned. The first analysis, which has been completed, used the full sample size of all of the patients who were randomized. This analysis looked at whether the intervention: 1) changed the complexity score of the medication regimen; 2) reduced the number of hospitalizations; and 3) reduced the number of emergency room visits. The second analysis, which is currently in progress, is looking at the same endpoints as the first analysis; however, sample size is limited to the patients that participated in an interview. This second analysis will incorporate user data with the interview data.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is roughly on target. Due to changes in staffing and the complexity of the analyses, the team is using a 1-year no-cost extension to complete the data analyses.

Preliminary Impact and Findings: Five-hundred nurses were enrolled in the study. Of these, 165 (33 percent) were randomized to the intervention arm. A total of 7,960 patients were included in the study, with 2,562 (32 percent) in the intervention arm. Patient outcome interviews were conducted among a randomly-selected subset of patients on a one-to-one basis, approximately 60 days after home care admission. The final survey group included 826 patients, 423 (51 percent) of which were selected from the intervention arm.

Descriptive statistics indicated that the demographic characteristics of nurses and patients were evenly distributed across the two study arms. Analysis of the intervention nurses' use of the electronic decision support tool and the effect of the intervention on patient outcomes is in progress.

Target Population: Adults, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Using Health Information Technology to Improve Transitions of Complex Elderly Patients from Skilled Nursing Facilities to Home

Principal Investigator:	Field, Terry, D.Sc.
Organization:	University of Massachusetts Medical School
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017817
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,188,157

Summary: This project developed and is evaluating a transitional care intervention: an electronic medical record (EMR)-based medication reconciliation system for medication monitoring and followup of elderly patients discharged from a skilled nursing facility (SNF) to ambulatory settings with the goal to reduce the incidence of drug-induced injury. The research team will evaluate the intervention through a time-series assessment to measure the efficacy of communicating key health information and alerts to outpatient primary care physicians and visiting nurses. Therapeutic monitoring guidelines have been developed and integrated into EpicCare, an ambulatory EMR used at the Fallon Clinic. Dr. Field and her team are measuring a range of outcomes to determine whether the intervention facilitates high-quality transitions, including the rate of followup office visits, the rate of appropriate monitoring for high-risk medications, and the incidence of adverse drug events (ADEs). Finally, they are analyzing the costs of developing and implementing the intervention. The results from this study will provide important insights into the effective use of clinical alerts and coordinated delivery of actionable information to improve the quality of care delivered to elderly patients transitioning from sub-acute care to the ambulatory setting.

Specific Aims:

- Evaluate the impact of automated scheduling alerts on the rate of followup office visits with an outpatient physician within 21 days of discharge from sub-acute care. **(Ongoing)**
- Evaluate the impact of automated monitoring alerts on the rate of appropriate monitoring for selected high-risk medications within 30 days of discharge from sub-acute care. **(Ongoing)**
- Evaluate the impact of a health information technology-based transitional care intervention on the incidence of ADEs within 45 days after discharge from sub-acute care. **(Ongoing)**
- Evaluate the impact of a health information technology-based transitional care intervention on the incidence of hospital readmission and emergency department visits within 30 days of discharge from sub-acute care. **(Ongoing)**

2011 Activities: During the first part of 2011, the team completed final programming, refinement, and testing of the clinical alerts and messages in the EMR. The intervention went live in July 2011. Because of delays, the team will only have 15 months of data collection. In addition, because they are identifying an average of only 10 discharges per month, they were concerned that they will not have time to accumulate a large enough sample size to run statistical analyses. As a result, the study team modified

their implementation to remove randomization and provide the information and alerts for all discharges. Analysis will now be based on a time-series assessment using 2 years of data from the period prior to the intervention as the comparison period.

Dr. Field and the team continued to develop manuscripts and disseminate the early work of this project on the development of the guidelines and the baseline results, including a manuscript, [Baseline and follow-up laboratory monitoring of cardiovascular medications](#), published in the September volume of *Annals of Pharmacotherapy*. A manuscript describing the process, required resources, and personnel costs of developing and implementing the transition intervention has been accepted for publication in *Informatics in Primary Care*. In addition, Dr. Field presented at the AHRQ Annual Conference in September.

Due to the significant time and resources necessary to develop, program, and refine the alerts and messages and program them into the EMR system, Dr. Field is using a 1-year no-cost extension to conduct the study and complete the analyses.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track according to the revised timeline, and project budget spending is on target.

Preliminary Impact and Findings: This project has no findings to date. Results will be available at the conclusion of the time-series assessment.

Target Population: Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

A Longitudinal Telephone and Multiple Disease Management System to Improve Ambulatory Care

Principal Investigator:	Friedman, Robert, M.D.
Organization:	Boston Medical Center
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017855
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,934

Summary: This study will assess the effectiveness of conversational computer telephony to monitor the care of patients with multiple complex chronic diseases and socio-demographic vulnerabilities who experience increased health care utilization and transitions from ambulatory to emergency department (ED) and hospital care. The objective is to reduce preventable ED and hospital utilization, improve quality of life, increase satisfaction with ambulatory care, improve disease-specific metrics, and reduce net payer costs. Telephone-Linked Care for Complex Patients (TLC-C) is a modification of the existing TLC-MultiDisease (TLC-MD) system, which targets patients with multiple chronic diseases. This modification focuses on identifying and intervening for clinical instability (i.e., the patient is at high risk for sudden, severe clinical decompensation). TLC-C uses conversational computer telephony to monitor patients' multiple diseases and clinical status between ambulatory care visits, detecting changes in clinical status that are associated with disease exacerbation and heightened risk of unscheduled urgent care (e.g., hospitalizations or ED visits). The system monitors patients through virtual visits, detecting and then notifying clinicians of important clinical problems. It also promotes patient self-care management (e.g., medication regimen adherence), scheduled medical visit appointment attendance, and patient preparation for ambulatory care visits, all of which have been associated with unscheduled urgent care services.

TLC-C utilizes information reported by patients during the virtual visits and clinical information about the patients that reside in their providers' clinical data repositories. Information in the repositories is derived from the patients' clinical encounters in clinics, laboratories, ED and hospital services, and other settings where they receive medical care. Information from the repository is transferred automatically to TLC-C daily. This information includes diagnoses, prescribed medications, scheduled primary care visits, and other clinical encounters, patient's disposition, laboratory and other test results, and other selected information used by TLC-C. In addition, the investigators implemented an expert system for directing the patient user to TLC-C modules likely to be of special use and interest to the patient.

A multi-method evaluation study of the patients, the providers, and the practice will include a two-arm randomized clinical trial of TLC-C versus usual care. The trial is evaluating the system in 240 patients followed for 6 months. Subject data are collected through in-person interviews at baseline, and through telephone interviews at followup, 3 and 6 months after baseline. The primary outcome will be unscheduled urgent care utilization (unplanned hospitalizations and ED visits). Secondary outcomes

will include patient quality-of-life, satisfaction, ambulatory appointment show rate, and net payer costs. Evaluation methods will include formative and summative qualitative studies of the implementation of the system; its use and performance over time; and its impact on patients, providers, and practices.

Specific Aims:

- Design, program, and lab test the system. **(Achieved)**
- Pilot test the system. **(Achieved)**
- Redesign and reprogram the system based on the pilot. **(Achieved)**
- Conduct an evaluation study. **(Ongoing)**
- Recruit patients. **(Ongoing)**
- Evaluate project. **(Upcoming)**
- Analyze study data. **(Upcoming)**
- Sustain and disseminate the system. **(Upcoming)**
- Write the final report and other manuscripts. **(Upcoming)**

2011 Activities: Activities focused on recruitment and enrollment of intervention and control participants, and on promoting intervention system use by intervention group participants. Increases in enrollment were seen following Institutional Review Board (IRB) approval in October 2010 to stop the requirement that potential subjects have any specific disease. Subjects who do not have any of the listed diseases will not get disease-specific guidance on the phone system but will receive the remainder of the TLC-C system, including medication support and visit adherence promotion. By the end of 2011, 218 study subjects had been enrolled, with 110 in the intervention group and 108 in the control group. Fifty of the 110 intervention subjects (45.5 percent) had made at least one TLC call.

During the beginning of 2011, project staff began to conduct calls with intervention group subjects prior to their first intervention call to promote system use and to remind participants that they would be receiving an intervention call. They also began to make additional calls to remind participants of their passwords. A TLC monitoring system was developed so staff could track scheduled and completed calls for study participants. Research staff also used the monitoring system to determine the effects of the introduction and continued use of steps to increase or maintain TLC system use by intervention group study participants, and to identify particular intervention group participants who need to be contacted by research staff about their use of the system. The research team received IRB approval to send a ‘wallet-card’ with information about the study to intervention group participants, and approval to resend the TLC instruction sheet upon request. In fall 2011, in an additional effort to increase use of the TLC system, the research team established an incentive system for intervention participants. This incentive system is set up as a lottery, with one entry each time a participant uses the TLC system, for up to four entries per participant per month. Random drawings have been held using these entries, and a gift card has been awarded to one winner each month since August.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track, and spending is roughly on target. Due to recruitment challenges in 2010, the project team utilized a 1-year no-cost extension to ensure adequate time for recruitment, implementation, analysis, and dissemination.

Preliminary Impact and Findings: This project has no findings to date because the clinical trial is ongoing.

Target Population: Adults, Chronic Care*, Low SES/Low Income*, Medicaid, Medically Underserved, Safety Net, Uninsured

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Randomized Control Trial Embedded in an Electronic Health Record

Principal Investigator:	Kahn, James O., M.D.
Organization:	University of California San Francisco (UCSF)
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017784
Project Period:	September 2008 – August 2012
AHRQ Funding Amount:	\$1,199,928

Summary: HIV/AIDS is a chronic illness and applying the chronic care model (CCM) to this disease may lead to improved outpatient care and easier, safer clinical transitions for HIV-infected patients. Clinical information systems (CISs) are a key element in the CCM. While most CISs have focused on the provider as the recipient of critical data, CISs that target patients might also improve health care. The electronic personal health record (ePHR) is a recent and increasingly common information system that allows patients to view data necessary to guide practical outpatient decisions and provides portability of clinical data between health care venues.

This project expanded an existing secure ePHR, called my Healthcare Evaluation Record Organizer (myHERO), to provide information, Web-based tools, and reminders to promote self-management, increase safer clinical transitions, and improve outcomes among patients with HIV/AIDS in a public health setting. myHERO is integrated with HERO, the electronic health record system used by the University of California at San Francisco's Positive Health Program, a primary care clinic that specializes in care for patients with HIV/AIDS. The enhancements included adding established tools to assess tobacco use, depression, anxiety, and medication adherence, and to translate responses into numeric scores that trigger decision-support for patients and directs them to resources or Web-based interventions.

A 12-month randomized controlled trial is evaluating the impact of the ePHR on clinical outcomes including: 1) qualities—i.e. trust, communication, and health promotion—of the patient-clinician interaction; 2) changes in patient behaviors such as adherence to antiretroviral medications and tobacco use; 3) clinical outcomes, i.e. CD4+ T-lymphocytes, detectable plasma HIV RNA, depression, anxiety, and quality of life; 4) safety, i.e. documentation of drug allergies, adverse events, and medication reconciliation; and 5) utilization, including office visits. In addition, the project team will evaluate patient and clinician experiences in engaging with the ePHR tools including patient access and use of support for tobacco cessation, depression abatement, anxiety reduction, adherence improvement, and patient and clinician satisfaction with the ePHR.

Specific Aims:

- Build the infrastructure and content of the ePHR to provide patient decision support, information retrieval, and communication tools. **(Achieved)**
- Evaluate patient and provider experiences using the ePHR, including patient access and use of health

education materials and patient-provider satisfaction with the ePHR. **(Ongoing)**

- Assess outcomes, including quality of patient-provider interactions, changes in patient behaviors, clinical outcomes, safety, and health services utilization. **(Ongoing)**

2011 Activities: Dr. Kahn and his research team completed data collection during 2011 and are using a 12-month no-cost extension to complete data analysis. An article, [A cross-sectional study of barriers to personal health record use among patients attending a safety-net clinic](#), was submitted in 2011 and published in the PLoS One Journal in early 2012. Dr. Kahn did not submit a report with a status of activities or project spending in 2011 to the AHRQ Research Reporting System

Preliminary Impact and Findings: The research team found that, among patients attending a safety-net HIV/AIDS clinic, mental health/substance abuse conditions were not barriers to engagement with Web-based health information. Level of computer competency was a way to identify individuals who required substantial computer training in order to fully participate in the study.

Target Population: Adults, Chronic Care*, HIV/AIDS

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Improving Pediatric Cancer Survivorship Care through SurvivorLink

Principal Investigator:	Mertens, Ann C., Ph.D.
Organization:	Emory University
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs through Health Information Technology (MCP)
Grant Number:	R18 HS 017831
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,198

Summary: As the number of cancer survivors increases, the need to educate primary care providers about the unique needs and care of these individuals has become more urgent. This is particularly true for childhood cancer survivors for whom cancer therapies, with overall cure rates of 75 to 80 percent, are highly successful. Yet high-quality individualized survivorship care is challenging due to: 1) multiple transitions in care among primary and specialty care providers; and 2) the lack of knowledge about survivor issues among providers, patients, and their families.

Dr. Mertens and her research team are addressing these challenges by building the SurvivorLink system, a personal health record with the goals to improve pediatric cancer survivors' transition to pediatric primary and specialty care and increase patient, family, and provider knowledge about survivor issues. SurvivorLink includes a cancer treatment summary, individualized risk- and late-effects screening profiles, and other clinical information needed to provide high-quality long-term care to survivors. SurvivorLink also provides educational materials that improve awareness of survivorship issues and best practices in survivor care, including continuing medical education (CME) credits to providers who complete educational materials using the SurvivorLink Web site.

SurvivorLink has three target user groups: patients and their families; providers; and researchers. Participants for this pilot study are being recruited through the five cancer treatment centers in the State of Georgia and Georgia Comprehensive Cancer Registry records. The impact of SurvivorLink will be evaluated by measuring outcomes related to both SurvivorLink utilization and the effects that utilization has on aspects of survivor care, including patient and provider awareness of survivor issues and percentage of patients receiving recommended survivorship care.

Specific Aims:

- Collect data on pediatric cancer survivors in SurvivorLink. **(Ongoing)**
- Facilitate the exchange of clinical information at key transitions. **(Ongoing)**
- Provide patients with easy access to individualized educational materials and evidence-based late-effects screening recommendations. **(Ongoing)**
- Provide researchers with longitudinal information on incidence of late effects in pediatric cancer survivors. **(Upcoming)**

2011 Activities: Recruitment for SurvivorLink has been a major focus of this year. The research team has employed several methods to recruit patients, including contacting individuals on the Georgia Comprehensive Cancer Registry, collaborating with local pediatric cancer clinics, and promoting SurvivorLink through social media. Additionally, the research team partnered with two cancer advocacy organizations, CURE and Camp Sunshine, to provide information about SurvivorLink at workshops, conferences, and other survivorship events.

To maximize its recruiting efforts, the research team analyzed recruitment numbers for each recruitment method. Of the 218 pediatric cancer patients contacted through Childrens' Healthcare of Atlanta, 23 (11 percent) registered with SurvivorLink after mail contact, and 49 (22 percent) after mail contact and a telephone call. Of these patients, individuals who previously attended a cancer survivorship clinic were significantly more likely to register with SurvivorLink than those who have not attended a survivorship clinic. At the community outreach survivorship events, 22 percent of patients or parents who engage with SurvivorLink staff registered with the Web site. Additionally, following outreach events, the average number of weekly visits to SurvivorLink increased by 25. In the first 4 months of a Facebook social media campaign, the SurvivorLink Facebook page received 645 views and 58 'likes.'

As of the end of 2011, 316 people registered with SurvivorLink. Of these, 132 were providers, 131 were parents, and 53 were patients. There have been 4,001 visits to the SurvivorLink Web site. The average number of pages viewed is 5.84, and the average length of time on the site is 6.98 minutes. Fertility and neurocognitive issues are among the most frequently searched types of information. Among providers who have visited SurvivorLink, 50 CME credits have been completed.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track with the revised timeline and the project budget spending is on track. The project is using a 1-year no-cost extension to allow additional time for patient recruitment.

Preliminary Impact and Findings: The project team conducted focus groups and semi-structured interviews with providers, patients, and parents to understand the needs of these groups. The focus groups indicated that providers want a system that allows efficient access to patient health information before the patient visit. Patients and their parents expressed concern about privacy from insurance companies, colleges, and employers. Additionally, the study staff learned that most parents were not familiar with the importance of survivor care.

Findings from focus groups with providers and parents of pediatric cancer survivors were incorporated into the development of the parent-patient portal of SurvivorLink. The patient-parent portal was designed with special attention to security and privacy. Similar to a social networking site, patients and parents can invite their primary care doctor and other physicians to access their survivor health plan online to facilitate information exchange, and can un-invite them at any time. As an added security measure, patients and parents are able to monitor who looks at their information. When patients or parents sign up, they receive a survivor health care plan and give permission for their providers to post information. The portal highlights tailored information for individual patients based on their risks. Patients and parents are also able to link their current medications with relevant health links and can store other information as scanable documents.

Target Population: Cancer, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

e-Coaching: Interactive Voice Response-Enhanced Care Transition Support for Complex Patients

Principal Investigator:	Ritchie, Christine S., M.D., M.S.P.H.
Organization:	University of Alabama at Birmingham (UAB)
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017786
Project Period:	September 2008 – June 2012
AHRQ Funding Amount:	\$1,199,999

Summary: When complex patients transition from hospital to home-based care they are at high risk for adverse events, including medical error. Studies examining the care transition intervention (CTI), for which nurses conduct home visits, telephone follow-up, and provide assistance at and after discharge, report that although it is a successful program, it is costly and not feasible in settings serving geographically-dispersed populations.

Dr. Ritchie and her research team developed a CTI-based, cost-efficient technological solution that uses an interactive voice response (IVR)-supported care transition coaching intervention, called e-Coach, which supports medical patients with complex conditions as they transition from hospital to home-based care. e-Coach uses the TeleSage software application and maintains a paper-based personal health record (PHR), provides patient medication self-management assistance, timely follow-up with primary or specialty care, and “red flags” when the patient’s condition deteriorates. e-Coach has a Web-delivered monitoring dashboard that displays meaningful data for the care transition coach to use to monitor patient status, listen to patient messages, and record responses. The team is performing a randomized control trial (RCT) involving patients with congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD) and who are discharged from the hospital. If e-Coach is successful, it is likely to be disseminated easily and might reduce medical errors in the hospital-to-home transition period as well as risks and costs of rehospitalizations.

Specific Aims:

- Randomize patients to compare the e-Coach intervention with usual care. **(Achieved)**
- Evaluate the use of the e-Coach system by patient and health care providers. **(Ongoing)**
- Evaluate the effect of e-Coach on patient outcomes, including 90-day rehospitalizations, successful community tenure at home after discharge from the hospital, and patient self-efficacy based on the Care Transition Measure. **(Ongoing)**
- Quantify the costs associated with the e-Coach intervention. **(Ongoing)**

2011 Activities: Activities related to the ongoing RCT were the main focus of 2011. As of the end of September, 3,428 patients were assessed for eligibility based on hospital census. After two levels of screening, 482 individuals with CHF or COPD were enrolled and randomized. Of these, 248 received

usual hospital discharge care, and 234 received the e-Coach intervention. Data collection occurred at 1-week, 1-month, and 3-month intervals following discharge. By the end of the year, 182 participants completed the intervention (in-hospital coaching, all IVR surveys, and follow-up with nurse-coaches as needed). Recruitment ended at the beginning of December. The last participant will end the 90-day follow-up period on February 29, 2012, and appropriate measures have been taken to ensure the final data collection call is completed that day.

The team made several updates to the data collection tools including: 1) developed a specific coding schema to label events leading to disenrollment or discontinuation of the study because participants no longer met inclusion criteria (e.g., implantation of a ventricular-assist device, pregnancy, etc.); 2) added drop-down calendars to data collection forms to calculate health care utilization by specific access dates; and 3) added new data collection forms to examine changes in inclusion status for participants receiving usual care to ensure balance between randomization arms of the RCT. At the end of the year, the project team began cleaning the data. This included resolving alerts in the data collection system when data were missing or incorrectly entered.

The primary challenge experienced by the team was patient recruitment, mainly due to hospital census limitations and the project's eligibility criteria. The team took several enrollment-increasing measures, including screening-protocol expansion, daily "environmental scanning" of the two study hospitals, and regular communication with staff in areas with high volumes of COPD and CHF patients.

Despite these measures, recruitment was still slower than anticipated, so Dr. Ritchie is using a 6-month no-cost extension to complete the RCT and subsequent data collection. As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and the project budget spending was on target.

Preliminary Impact and Findings: Preliminary findings include the high receptivity from patients on the intervention, a higher-than-anticipated response rate on the IVR surveys among patients receiving the IVR-supported intervention, and a reduction in the number of rehospitalizations for the intervention versus the control group. In addition, the use of IVR technology rather than in-home nursing care transition support has allowed this project to extend its geographic reach, as evidenced by the enrollment of participants from 53 of the 67 counties in the State of Alabama and seven other States.

Target Population: Chronic Care*, Chronic Obstructive Pulmonary Disease, Congestive Heart Failure, Elderly*, Medicare, Racial/Ethnic Minorities*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Using Electronic Data to Improve Care of Patients With Known or Suspected Cancer

Principal Investigator:	Singh, Hardeep, M.D., M.P.H.
Organization:	Baylor College of Medicine
Mechanism:	RFA: HS08-002: Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health Information Technology (MCP)
Grant Number:	R18 HS 017820
Project Period:	September 2008 – September 2012
AHRQ Funding Amount:	\$1,199,531

Summary: Patients with known or suspected cancers transition through several ambulatory care settings to receive timely diagnosis and treatment. The survival benefits conferred by early diagnosis and treatment depend on well-coordinated care. This project tests the use of health information technology (IT) to identify patients for whom the diagnosis of specific cancers (prostate, lung, or colon) has been delayed.

This project is using data from two electronic health record (EHR) systems (the Veterans Administration's [VA's] Computerized Patient Record System and Veterans Health Information Systems and Technology Architecture, and EMRx, the EHR at the Scott and White Health system, a large private integrated health care delivery system in central Texas) to develop, test, and refine queries to mine a clinical data warehouse for triggers that might signal diagnosis delays. Providers in the intervention group of the randomized controlled trial (RCT) receive electronic communication and surveillance if potential delays in their patients' diagnostic work-up are identified by the triggers. Outcome measures, obtained through chart reviews, consist of time intervals between several key steps in the optimal pathway of diagnosis.

Specific Aims:

- Identify patients with cancer-related diagnostic delays using trigger-based data mining of an EHR repository. **(Ongoing)**
- Determine the effectiveness of a health IT-based intervention to facilitate cancer diagnosis as compared with usual care. **(Ongoing)**

2011 Activities: During 2011, Dr. Singh and his team continued to develop cancer triggers based on the colorectal cancer triggers they developed in 2010. By the end of 2011, the colorectal and prostate cancer triggers were developed, and the data collection, validation, and analysis of the triggers for identifying patients with cancer-related diagnostic delays were complete at both the VA and non-VA site. An abstract based on preliminary findings of the colon and prostate cancer triggers at the VA site was presented at the 2011 VA Health Services Research and Development Service Annual Meeting in Washington, D.C. in February 2011, and at the Society of General Internal Medicine 34th Annual Meeting in Phoenix, Arizona in May 2011. The team also completed a manuscript describing the results of both the colorectal and prostate EHR triggers to detect delays in cancer diagnosis. This manuscript is under review for publication.

Each trigger required mining more than 200,000 medical records. A team comprised of clinical providers and a programmer met weekly to define the appropriate clinical criteria and determine how to implement them, taking into account the limitations of the health information systems at the sites. Each trigger is composed of several clinical rules (e.g. criteria). Each rule required multiple record review sessions, during which providers tested the triggers by identifying the documented clinical evidence that supported or contradicted the triggers' rules. Validation included a medical chart review to determine whether the identified patients were truly at risk for delayed cancer diagnosis.

The RCT is underway to test the intervention of delivering information about trigger-identified potential delays in the care of colorectal or prostate cancer to their respective primary care providers. The intervention consisted of data mining to facilitate cancer diagnosis using triggers developed for the first aim, followed by targeted electronic communication and surveillance, as compared with usual care. Recruitment for the RCT began in March 2011 and has been completed at both the VA and non-VA sites. Sixty-three providers have consented to participate in the study, and demographics have been collected from each provider via an electronic survey. A total of 25 rounds of data have been extracted for 13 months, and intervention group providers are being contacted for positive triggers. A preliminary analysis of the data collected thus far is underway.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is on target. Due to initial project delays in 2009 and the unanticipated amount of time needed to develop the initial triggers, the project team is using a 1-year no-cost extension to ensure adequate time for the RCT and subsequent analysis and manuscript preparation.

Preliminary Impact and Findings: A total of 292,587 and 291,773 patient records were evaluated by the triggers for prostate and colorectal cancer, respectively. Overall, the triggers identified 1,564 patients with potential delays in care (426 for prostate and 1,138 for colorectal cancer triggers). Chart reviews performed on all 426 prostate and 258 randomly-selected colorectal cancer trigger-positive records revealed that 299 (70.2 percent) and 166 (64.3 percent) were correctly identified as having delayed care. Additionally, reviews identified that 11.6 percent of patients with delayed care were subsequently diagnosed with cancerous or precancerous lesions.

Target Population: Adults, Cancer: Colon, Lung, and Prostate, Veterans

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Closing the Feedback Loop to Improve Diagnostic Quality

Principal Investigator:	Berner, Eta, Ed.D.
Organization:	University of Alabama at Birmingham
Mechanism:	RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Through Health Information Technology (EQM)
Grant Number:	R18 HS 017060
Project Period:	November 2007 – August 2011
AHRQ Funding Amount:	\$998,509

Summary: The inpatient setting allows alternative diagnoses to be considered whenever there is a lack of response to therapy or when an adverse event occurs. Determining whether a diagnosis is correct in an outpatient setting may be difficult because patients with inaccurate diagnoses may fail to follow up, get better on their own despite the inaccurate diagnosis, or seek care elsewhere, so that the original provider never learns of the error. Indeed, a “correct” diagnosis may not be discovered until a later date when a biopsy, autopsy, hospital stay, or adverse event occurs and establishes a disparate diagnosis.

This project sought to track outcomes of initial diagnosis and to provide that information to clinicians to give feedback and the opportunity to revise initial diagnoses. The assessment of outcomes was assisted by the involvement of patients. The metric for the quality of the diagnosis was whether the patient’s condition resolved in a timely and appropriate manner, or whether—as the result of feedback the initial diagnosis— was modified in a timely manner.

The project developed automated processes for proactive followup and ongoing rapid feedback to physicians in two types of outpatient settings: 1) three ambulatory clinics (the University of Alabama at Birmingham [UAB]-Huntsville Family Practice; United Cerebral Palsy Clinic [UCP]; and the UAB-HIV Clinic); and 2) an emergency department (ED) (Shands-Jacksonville). The ambulatory sites each used different electronic health records (EHRs). UCP used the WorldVista EHR, UAB used Touchworks EHR, and UAB-HIV used a proprietary EHR. The ED site used the McKesson Horizon Patient Folder and a proprietary ED system that provided a computer-generated paper template that was customized to the patient’s chief complaint.

Different interventions were used at each type of site. The clinic site intervention was an interactive voice response (IVR) system that collected followup data for a feedback report to physicians on patient health status and medication adherence. The feedback report used an interface between the EHR and a database that can be integrated with a variety of systems. The ED intervention was an automated followup and feedback report to the ED physicians on the final diagnoses of patients who were admitted to the hospital as compared to their initial ED diagnoses.

Outcome measure included providers’ responses to the feedback; satisfaction with the process; its impact on diagnostic and therapeutic quality; response to use of the IVR and ED feedback systems; and use of the feedback by physicians. For the clinic sites, additional assessments included patient satisfaction and impact on health care costs.

Specific Aims:

- Develop a system within three different ambulatory EHR systems in three different types of ambulatory settings that includes proactive followup of patients' response to treatment (including medication adherence and adverse events) and feedback to health care providers. **(Achieved)**
- Assess the impact of automating the followup and feedback system. Impact will be measured in terms of: 1) diagnostic quality; 2) prevention of adverse events; 3) patient satisfaction with clinical care; and 4) health care costs. **(Achieved)**
- Develop and evaluate an automated system for feedback to emergency medicine physicians of the concordance between their initial diagnoses and patients' final diagnostic outcomes. **(Achieved)**

2011 Activities: The 1-year no-cost extension provided the opportunity to complete data collection, analysis, and writing of results. Manuscripts under development during this period included a descriptive paper summarizing the results of the concordance analyses; lessons learned about implementing IVR for ambulatory followup; patient satisfaction results; and a main paper summarizing the whole study and outcomes, including clinical, costs, and physician and patient satisfaction. Presentations on project results were given, including a poster presentation focusing on the patient satisfaction survey at the American Medical Informatics Association spring meeting, and a second presentation on the development of the medication compliance scale presented at the Society for Behavioral Medicine. Dr. Berner also presented a Webinar about the project to researchers at Creighton University in March. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. All project activities were completed when the project ended in August 2011.

Impact and Findings: Baseline data showed that 10-to-20 percent of ambulatory patients reported that their problems were not resolved within a week of their acute care visit. Many reported that their problem persisted after 3 weeks. A large proportion of patients did not contact their health care providers when they did not improve as expected. Patient satisfaction with the program was high throughout all phases of the program.

Physicians who viewed the feedback found it helpful. Cost analyses showed that if a followup system was implemented routinely the expense could be offset by increased revenue from return visits, with the potential to improve the quality of care and avert higher costs of hospitalizations. In the secondary study, the overall dissonance rate between ED and discharge diagnoses was approximately 10 percent. Providing feedback to physicians that could address the discordant diagnoses must address the workflow, confidentiality, and time constraints inherent in an ED setting.

Patients and providers appreciate 'closing the feedback loop.' Patients who receive followup calls are more satisfied with their overall care than those who do not. The project demonstrated that IVR systems are a feasible approach for patient followup in ambulatory settings. Costs for such followup can be offset by increased patient care revenue, and early followup may avert more costly health care expenses and can potentially improve the quality of care.

Target Population: Adults, Cerebral Palsy, HIV/AIDS

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Synthesis and Dissemination

Developing and Using Valid Clinical Quality Metrics for Health Information Technology with Health Information Exchange

Principal Investigator:	Kaushal, Rainu, M.D.
Organization:	Joan and Sanford I. Weill Medical College of Cornell University
Mechanism:	RFA: HS07-002: Ambulatory Safety and Quality Program: Enabling Quality Measurement through Health Information Technology (EQM)
Grant Number:	R18 HS 017067
Project Period:	September 2007 – March 2011
AHRQ Funding Amount:	\$974,545

Summary: Traditional metrics for measuring quality of care in ambulatory settings have been largely designed to measure ambulatory care in isolation, independent of interactions with other health care providers and settings. Innovations in health care driven by the implementation of health information technology (IT) with health information exchange (HIE) require revised sets of quality metrics to assess the impact these interventions promise. For example, new metrics are needed to capture the effects of data sharing between generalists and specialists in the ambulatory setting and of sharing data across transitions between inpatient and outpatient settings. Further, new quality metrics are needed to capitalize on the rich clinical data that could be extracted from electronic health records (EHRs) and other electronic sources.

This project developed a set of quality metrics, including existing and newly-developed metrics, that could potentially capture the effects of health IT with HIE and be retrieved electronically. This process was accomplished through the contributions of the Health Information Technology Evaluation Collaborative, a multi-institutional academic collaborative established to evaluate health IT and HIE initiatives in New York State, with additional input from the New York State Department of Health and four regional health information organizations that are implementing health IT with HIE in the ambulatory setting. The quality metric set was validated by a national expert panel with expertise in health IT, quality measurement, health care policy, and health economics.

Dr. Kaushal's team tested the accuracy of electronic retrieval of the data for the metric set compared to the standard manual chart review. This work was done in collaboration with a network of federally-qualified health centers. The metric set was then used to evaluate the effects on quality of using health IT with HIE, specifically EHRs and electronic portals. To do so, the team prospectively followed all eligible patients from selected federally-qualified health centers over 1 year to determine if quality improves using health IT with HIE.

Specific Aims:

- Develop a modified set of quality metrics that can be retrieved electronically and is sensitive to the types of improvements in quality that health IT with HIE may contribute in an ambulatory care setting. **(Achieved)**
- Validate the modified quality metric set. **(Achieved)**
- Test the reliability of electronic retrieval of the modified quality metric set. **(Achieved)**

- Use the modified quality metric set to evaluate the long-term effects of using health IT with HIE on improving health care quality. **(Achieved)**

2011 Activities: In the first years of the project, existing metrics were iteratively rated and refined over time and then validated by an expert panel. Next, the reliability of the metrics was assessed by comparing electronic reporting to manual review. Performance on the metrics over time was also measured. Two no-cost extensions, totaling a year-and-a-half, (1-year and 6-months) were necessary to conclude testing of the electronic reporting and quality improvement. Additionally in 2011, the team focused on manuscript development and the dissemination of study results. As of March 2011, this project has been completed.

Impact and Findings: Seventeen metric sets for measuring ambulatory care quality were identified through a literature review. The metric sets contained a total of 1,064 individual metrics. Of these, the team excluded 122 duplicates; 84 metrics not relevant to the ambulatory care setting; 136 not relevant to adult primary care; 189 consisting of provider, practice, or health plan characteristics; and 23 on patient or provider satisfaction. The remaining 510 metrics underwent a rating process, in which the scores from raters were averaged to create a summary score. A 36-member national expert panel was convened to validate the final metric set. The metrics were assessed according to feasibility of delivering data electronically to the physician at the point of care, potential impact on medical decision making, clinical importance, feasibility of reporting data electronically, and a global rating. The final metric set included 18 selected from metrics already endorsed by national organizations and 14 *de novo* metrics to address targeted care coordination more explicitly than the existing metrics. The process of developing and validating the metrics raised five issues that are highly relevant to the current national discussion on EHRs and quality: 1) data structure; 2) EHR usability and workflow; 3) community integration; 4) vendor maturity and priorities; and 5) quality metric specification.

The EHR was then evaluated for its use as an electronic documentation and reporting tool as well as for its potential to improve care over time. Twelve metrics were electronically obtained and manually extracted from the EHR. Using the manually extracted data as the standard, the reliability of electronic reporting was high overall. However, there was substantial variation in accuracy across the metrics. Quality improved significantly over time.

The development and validation of this metric set predated and informed the measures for the Centers for Medicare and Medicaid Services EHR Meaningful Use. Of the 18 existing metrics, 15 are included in Stage 1 Meaningful Use in identical or similar forms. None of the metrics developed *de novo* are reflected in Stage 1 Meaningful Use, in part because they are novel metrics that do not yet have accompanying specifications. The existing metrics in the study were aligned with and supported the conceptual basis of Meaningful Use. The metrics developed for this study could not be easily reported by most vendor EHRs. This observation highlights larger policy ramifications as community providers strive to demonstrate Meaningful Use.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Massachusetts Quality E-Measure Validation Study

Principal Investigator:	Schneider, Eric, M.D.
Organization:	RAND Corporation
Mechanism:	RFA: HS07-002: Ambulatory and Safety Quality Program: Enabling Quality Measurement Through Health Information Technology (EQM)
Grant Number:	R18 HS 017048
Project Period:	September 2007 – August 2011
AHRQ Funding Amount:	\$995,575

Summary: Although the National Quality Forum has endorsed 26 standardized measures of ambulatory care for national priority conditions, measurement of and reporting on the quality of care delivered by office-based ambulatory care physicians have lagged. The implementation of electronic health records (EHRs) could revolutionize ambulatory quality measurement by increasing the validity of clinical measures and reducing the cost and burden of data collection.

This project evaluated the readiness of structured EHR data to support ambulatory clinical quality measurement. Using the Ambulatory Care Quality Alliance (AQA) ambulatory care measurement set, the study team compared quality measures by applying two standard measurement methods: 1) a “hybrid method,” combining claims data with medical record review; and 2) a “claims-only method,” based upon claims data aggregated across commercial health plans and the Medicare program. The project included primary analyses with formal hypothesis testing and secondary analyses to identify and prioritize high-impact, short- and long-term modifications to community-wide, office-based EHR systems that support and accelerate the dissemination of ambulatory clinical quality measurement.

Massachusetts Health Quality Partners has been developing EHR-based quality measure specifications and data extraction logic for the AQA ambulatory quality measure set. In addition to the implementation of interoperable EHRs, the Quality and Usage Data Coordinating Center was developed and implemented for selective retrieval, linkage, and storage of patient-level clinical data elements that can be used to calculate clinical quality measure results.

Specific Aims:

- Recruit a cohort of adult ambulatory patients from two communities that are piloting community-wide implementation of structured EHRs to compare a quality measurement method based on structured EHR data to a hybrid method involving a combination of aggregated claims data and medical record review. **(Achieved)**
- Compare a measurement method based on structured EHR data to a claims-only method based on a novel database that aggregates claims data from commercial health plans and Medicare. **(Achieved)**

2011 Activities: The development of the medical record abstraction tool and protocol was completed, and the instrument was programmed into Microsoft Access for easy use. The patient survey instrument, including revisions based on feedback gathered from cognitive testing, was also completed.

Data from the first aim were transferred from the health plans to the study team. The research team

developed a plan to obtain sample data with the right number and mix of patients. Internal review board (IRB) approval for fieldwork was obtained and initiated as scheduled. The remainder of the 8-month no-cost extension period allowed the final data collection and analysis to be completed. As last self-reported in the AHRQ Research Reporting System, project progress was on track and project budget spending was on target. This project was completed in August 2011.

Impact and Findings: The project team was not able to report the anticipated quantitative results expected in the two aims of the study. Nevertheless, the project produced numerous insights into the strategy for evaluating the availability and quality of performance data from community-wide health information exchange (HIE), including evaluation tools and a lengthy list of challenges that will confront future evaluators seeking to carry out similar work.

Barriers to evaluating performance measurement in the context of community HIE included:

- Slow and incomplete implementation.
- Technical problems.
- Legal and regulatory barriers to use of HIE data for evaluation.
- Lack of consistency across IRBs and other legal entities reviewing and overseeing the data evaluation protocol.
- Challenge to engaging patients.
- Sampling challenges:
 - Incomplete participation.
 - Reliance on two health plans to provide a commercial insurance sample.
 - Inability to selectively sample patients with chronic disease prior to recruitment.
 - Low physician submission of data.
- Incomplete cooperation of community physicians.
- Low response rates to health-plan member survey.

While the project established the feasibility of the protocol in part, the final sample of 276 patients completing the survey and providing consent for medical record review was less than one-quarter of the anticipated sample. The final analytic sample required medical record review, which was logistically challenging.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Table 11: Grant Summaries (Health Information Technology PAs)

Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Balasubramanian, Hari, MS, PhD	Improving Patient Access and Patient-Clinician Continuity Through Panel Redesign	HS08-268	174
No	Basco, William, MD	Assessment of Pediatric Look-Alike, Sound-Alike Substitution Errors	HS08-268	176
No	Fink, Arlene, MA, PhD	Developing and Evaluating Online Education to Improve Older Adults Health Information	HS08-268	178
Yes	Fleming, Neil Stewart, MA, PhD, CQE	Impact of Health Information Technology on Primary Care Workflow and Financial Measures	HS08-268	180
No	Handley, Margaret, PhD, MPH	Implementation Outcomes of a Health IT Program For Vulnerable Diabetes Patients	HS08-268	182
No	Levy, Douglas, PhD, MPH	Economic Analysis of an IT-Assisted Population-Based Cancer Screening Program	HS08-268	185
No	Nemeth, Lynne, MS, PhD	Synthesizing Lessons Learned Using Health Information Technology	HS08-268	187
Yes	Vawdrey, David Kent, MS, PhD	Electronic Medication Management	HS08-268	189
Yes	Zhou, Li, MS, PhD	Improving Outpatient Medication Lists Using Temporal Reasoning and Clinical Texts	HS08-268	192
Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Ballard, David J., PhD, MD, MSPH	Impact of Health IT Implementation on Diabetes Process and Outcome Measures	HS08-269	194
No	Buis, Lorraine, MSI, PhD	Text Messaging to Improve Hypertension Medication Adherence in African Americans	HS08-269	196
No	Cummins, Mollie Rebecca, MSN, PhD	Supporting Continuity of Care for Poisonings with Electronic Information Exchange	HS08-269	198
No	Czaja, Sara, PhD, MS	Improving Meaningful Access of Internet Health Information for Older Adults	HS08-269	200
No	Dalal, Anuj K., MD	An Automatic Notification System for Test Results Finalized after Discharge	HS08-269	202
No	Eaton, Charles B., MD, DABFP, MS	eHealth BP Control Program	HS08-269	204
No	Garfield, Craig F., MD, MAPP	NICU-2-HOME: Using HIT to Support Parents of NICU Graduates Transitioning Home	HS08-269	206
No	Glanz, Jason, MSI, PhD	An Evaluation of an Interactive Social Media Website for Parents who are Concerned about Immunizing their Children	HS08-269	208
No	Kahn, Michael, PhD, MD	Enhancing Fulfillment Data in Community Practices for Clinical Care and Research	HS08-269	210
No	Kearns, William D., MA, PhD	Evaluation and Integration of an Automatic Fall Prediction System	HS08-269	212
No	Krist, Alexander H., MD	Promoting Use of an Integrated Personal Health Record for Prevention	HS08-269	215
No	Lai, Jin-Shei, PhD, MS	Symptom Monitoring and Reporting System for Pediatric Chronic Illness	HS08-269	218

No	Li, Baoxin, PhD, MS	Exploring Clinically-relevant Image Retrieval for Diabetic Retinopathy Diagnosis	HS08-269	220
No	Mane, Ketan, PhD, MS	VisualDecisionLinc: Real-Time Decision Support for Behavioral Health	HS08-269	222
No	Mollica, Richard, MD, MA, MAR	The Virtual Patient for Improving Quality of Care in Primary Healthcare	HS08-269	224
No	Nease, Donald, MD	Health Information Exchange and Ambulatory Test Utilization	HS08-269	227
No	Olson, Ardis L., MD	Healthy Teens TXT ME; Information Technology to Change Teen Health Risk Behaviors	HS08-269	229
No	Ozer, Elizabeth, PhD, MA	Improving Adolescent Primary Care Through An Interactive Behavioral Health Module	HS08-269	232
No	Rimmer, James Howard, MS, PhD	Improving Health Care Quality Through Health Information Technology for People With Intellectual Disability	HS08-269	234
No	Shelley, Donna, MD, MPH	Testing Clinical Decision Support for Treating Tobacco Use in Dental Clinics	HS08-269	236
No	Sockolow, Paulina, DrPH, MBA, MS	Barriers and Facilitators to Implementation and Adoption of EHR in Home Care	HS08-269	238
No	Wexler, Randell, MD, MPH	Use of HIT to Increase Primary Care Access in Medicaid Patients	HS08-269	240
No	Williams, Laurie Ann, MBA, PhD	Use of Affordable Open Source Systems by Rural and Small-Practice Health Professionals	HS08-269	242
No	Ziemer, David C., MD, MPH	Computer Assisted Medication and Patient Information Interface (CAMPPI)	HS08-269	244
Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Arora, Sanjeev, MD	Project ECHO Hepatitis C Ambulatory Care Quality Improvement in New Mexico through Health Information Technology	HS08-270	246
No	Atlas, Steven J., MD	The Medication Metronome Project	HS08-270	248
No	Atlas, Steven J., MD	Technology for Optimizing Population Care in a Resource-Limited Environment	HS08-270	250
No	Bates, David W., MD, MSc	Improving Uptake and Use of Personal Health Records	HS08-270	252
No	Gance-Cleveland, Bonnie, MA, PhD	Health Information Technology to Support Clinical Decision Making in Obesity Care	HS08-270	254
No	Green, Lee A., MD, MPH	Information Technology Implementation by Cognitive Engineering of Organizational Routines	HS08-270	256
No	Haas, Jennifer S., MD, MSPH	Health IT Enhanced Family Health History Documentation & Management in Primary Care	HS08-270	258
No	Hazlehurst, Brian L., MA, PhD	Automating Assessment of Obesity Care Quality	HS08-270	260
No	Johnson, Kevin B., MD, MS	My MediHealth: A Paradigm for Children-Centered Medication Management	HS08-270	262
No	Levick, Donald, MD, MBA	Data Flow & Clinical Outcomes in a Perinatal Continuum of Care System	HS08-270	264
No	McConnochie, Kenneth, MA, PhD	Facilitators and Barriers to Adoption of a Successful Urban Telemedicine Model	HS08-270	266
No	McTigue, Kathleen M., MS, MD, MPH	Online Counseling to Enable Lifestyle-focused Obesity Treatment in Primary Care	HS08-270	269
No	Nkoy, Flory, MD, MS, MPH	Improving Post-Hospital Transitions and Ambulatory Care for Children with Asthma	HS08-270	271

No	Parsons, Amanda, MSc, MD	Bringing High Performing Systems to Small Practices	HS08-270	274
No	Piette, John D., PhD, MS	Trial of the CarePartner Program for Improving the Quality of Transition Support	HS08-270	277
No	Roberts, Mark Stenius, MPP, MD	Self Management & Reminders with Technology: SMART Appraisal of an Integrated PHR	HS08-270	279
No	Sequist, Thomas D., MD, MPH	A Risk Based Approach to Improving Management of Chronic Kidney Disease	HS08-270	281
No	Smith, Kenneth J., MD, MS	Virtual Continuity and its Impact on Complex Hospitalized Patients' Care	HS08-270	283
No	Stockwell, Melissa S., MD, MPH	Flu Alert: Influenza Vaccine Alerts for Providers in the Electronic Health Record	HS08-270	285
No	Storch, Eric, PhD, MS, MPhil	Utilizing Health Information Technology to Improve Health Care Quality	HS08-270	287
No	Weiner, Michael, MD	Medication Reconciliation to Improve Quality of Transitional Care	HS08-270	289
Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (P50)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Gustafson, David H., PhD	Bringing Communities and Technology Together for Healthy Aging	HS10-016	291

Improving Patient Access and Patient-Clinician Continuity Through Panel Redesign

Principal Investigator:	Balasubramanian, Hari, M.S., Ph.D.
Organization:	University of Massachusetts Amherst
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 018795
Project Period:	February 2010 – February 2012
AHRQ Funding Amount:	\$100,000

Summary: Primary care practices in the United States must balance the timeliness of care delivery with its continuity. Continuity of care includes balancing the lead time for appointments, with the goal of having patients see their own primary physician whenever possible. Timeliness and continuity are intrinsically tied to the makeup of the patient population—the “physician-patient panel”—that a physician oversees. In addition to these priorities, teaching hospitals must take into account the learning requirements of its medical residents. In order to prepare for future practice, residents should be exposed to the widest possible range of clinical experiences.

Using patient appointment data, physician-patient panel sizes, and physician case mix, Dr. Balasubramanian and his team are investigating how group practices can manage physician and resident-patient panels to improve timeliness of access and continuity. They are developing a quantitative decision support system to help clinicians, practice managers, and health systems answer the following questions:

1. How should physician-patient panel composition be altered over time to best match patient demand with physician supply?
2. How should practices best match patient and physician preferences, while simultaneously considering the influence of panel size and case mix on patient access?
3. How many additional new patients can be empanelled without adversely affecting the goals of timely access and continuity?

In developing the system, the project team constructed a general modeling framework for managing physician and resident-patient panels in a group practice and utilized systems engineering methods (optimization and discrete event simulation) to model the system over time. By incorporating specific features such as patient and physician preferences, changes in scheduling regimens, and changes in the supply and demand dynamics of a practice, the project team will extend the framework’s applicability to various primary care settings. The models will be disseminated through a Web-based decision tool.

Specific Aims:

- Develop a modeling framework that can translate generally to various primary care settings. **(Ongoing)**
- Extend the model’s ability to dynamically generate optimal panels and incorporate changes in physician availability and patient demand over time. **(Ongoing)**

- Develop and disseminate the first two aims in a Web-based decision support tool for clinicians, practice managers, and health care systems. **(Ongoing)**

2011 Activities: Retrospective data from primary care clinics were used to develop computer simulation models to optimize physician-patient panels. Visit rate, patient co-morbidities, case mix, physician preferences, and physician capacity were assessed as model inputs. Particular emphasis was placed on the use of physician teams to manage urgent care appointments and maximize continuity of care. In the context of medical resident education, where a heterogeneous physician-patient panel offers greater learning opportunities, Dr. Balasubramanian developed a measure of imbalance of resident panels to determine the mix of diagnoses in each resident's panel. Next, a patient reassignment model was developed and applied to the data to attempt to correct the imbalance in resident panels. Finally, the impact of the patient reassignment model was assessed. The patient reassignment model will be turned into a Web-based decision support tool for use by other practices.

Due to delays initiating the project, Dr. Balasubramanian is using a 1 year no-cost extension. As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and the project budget is roughly on target.

Preliminary Impact and Findings: Encounter data from a primary care clinic at the Massachusetts General Hospital were characterized for a 21-month period, July 1, 2008 to April 30, 2010. The data indicated that the practice consisted of 258 residents and approximately 17,000 patients. Using data from 14 residents and three preceptors, Dr. Balasubramanian examined the number of diagnoses per resident panel versus the number of patient visits. This analysis showed a wide variation in number of diagnoses per resident panel and that patients with more diagnoses have more clinic visits. The patient reassignment model was applied both within and across preceptor panels. Reassigning patients within a preceptor panel reduced the imbalance and maintained continuity between the preceptor and patients. Reassigning patients across preceptor panels further reduced the imbalance; however, it also decreased continuity of care. By applying the model within and across preceptor panels, the difference between number of diagnoses and number of visits was reduced. Not-yet-optimized panels were compared with optimized panels at current physician demand and with a 10 percent increase in physician demand. The optimally-designed panels with the 10 percent increase in demand offered more capacity than the not-yet-optimized panels without the increased demand. The models indicated optimized physician-patient panels increase physician capacity and may create an opportunity to mitigate physician shortages.

Dr. Balasubramanian noted that while reassignment of patients across preceptors would have serious ramifications for continuity of care, the model may be applied to assign new patients to physicians as well assign patients to new residents.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Assessment of Pediatric Look-Alike, Sound-Alike Substitution Errors

Principal Investigator:	Basco, William, M.D.
Organization:	Medical University of South Carolina
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 018841
Project Period:	April 2010 – March 2012
AHRQ Funding Amount:	\$100,000

Summary: Look-alike, sound-alike (LASA) medication errors occur when a patient receives an incorrect medication because its name is spelled or sounds like another medication. While medication errors have been studied in the pediatric population, the frequency of LASA-specific errors in pediatric prescriptions is not documented or understood well.

This study is identifying pediatric medications that are at highest risk of causing child harm through LASA errors and refining a method for “flagging” individual prescriptions as potential errors and creating screening alerts. A modified Delphi approach with a panel of practicing general pediatricians is being used to define a target list of 200 LASA medication pairs. The error rates of these 200 medication pairs will then be estimated by reviewing patient medication histories and diagnostic data. After estimation of the error rate, the positive predictive value will be identified for the screening alerts.

Research results could help guide the creation of a computerized set of pediatric-specific LASA screening alerts that could be implemented in the pharmacy setting to reduce LASA errors for children. This research will lay the groundwork for development of a larger-scale implementation study in pharmacy settings, with the goal of reducing pediatric ambulatory LASA errors.

Specific Aims:

- Identify a subset of known LASA drug pairs that are prescribed in ambulatory pediatric care. **(Ongoing)**
- Estimate frequencies of screening alerts (potential LASA substitution errors) in these drug pairs, and determine the positive predictive values (true positives) of the screening alerts. **(Ongoing)**

2011 Activities: The project used a Delphi process to identify the LASA list of medications. An online survey facilitated the Delphi process, presenting 50 drug pairs to each of the 38 physician survey recipients. The survey questions were framed in the following form: “Let’s say a child has to be on Adderall every day, and by mistake they get Inderal.” The respondents are asked: “Please score the severity of the potential harm that might occur from not getting Adderall. Also, please score the severity of potential harm from getting Inderal by mistake.” Dr. Basco and his research team have recruited pediatricians from around the country to participate and fill out the LASA survey. The third round of surveys were completed by physicians and in early 2012, the research team will complete the cluster analyses on third-round rankings in order to determine which pairs to include in the estimate of the frequency-of-substitution errors.

To measure the error rates of the final list of medication pairs, the research team will review patient medication histories and diagnostic data. The team has successfully obtained the Medicaid data for this component of the evaluation and has removed all duplicate entries. Further, they have identified a Food and Drug Administration file that contains cross-references for brand-name drugs with their corresponding generic names, allowing the electronic linkage of drugs that are the same but have different names.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track in some respects but not others. The project is somewhat behind schedule on the second aim to estimate frequencies of the potential LASA substitution errors, in part because of the time required to match generic and brand drug names. However, based on previously-done set-up work to develop a method for measuring frequencies of LASA substitution errors, the project team expects to meet milestones on schedule in 2012. Project spending is on target.

Preliminary Impact and Findings: Of the initial 1,784 LASA pairs, 917 were retained for the Delphi surveys. Participating physicians were able to identify pairs where the substitutions posed low potential harm (e.g. chlorpheniramine and cholestyramine), as well as pairs that represented high risk of harm for not receiving the intended drug (e.g. amiodarone and amantadine), high risk of harm for receiving the second drug in error (e.g. cetirizine and clonidine), and pairs where the potential harm was high from either not receiving the intended drug or from erroneously receiving the delivered drug (e.g. Tenex and Xanax).

The Delphi process was successful in identifying drugs that the participants felt were of high potential harm to a patient should a substitution occur.

Target Population: Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Developing and Evaluating Online Education to Improve Older Adults' Health Information

Principal Investigator:	Fink, Arlene, M.A., Ph.D.
Organization:	Langley Research Institute
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 019745
Project Period:	September 2010 – September 2012
AHRQ Funding Amount:	\$52,119

Summary: As an increasing number of Americans, including seniors, are turning to the Internet for information about health care, the ability to identify accurate, high-quality health Web sites can be difficult. There is little data about older consumers' awareness of the varying quality of health care information on the Internet, and whether or not seniors are able to distinguish between high- and low-quality Web-based health information.

The goal of this project is to develop and evaluate the first theory-based online health educational program for people aged 55 and older. The program aims to improve older adults' ability to identify high-quality health Web sites and to promote self-efficacy for communicating with physicians.

The project conducted focus groups to identify older adults' preferences for online learning about health topics to inform the design of an interactive online educational program. The use of this program will be compared to a program of educational materials, developed by the National Library of Medicine (NLM), that are not interactive and not geared specifically to older adults. Interviews with users of each of the two programs will document differences in participants' knowledge and skill in identifying trustworthy health Web sites and in communicating with physicians. The project will result in a theory-based educational program developed with the cooperation and advice of older health consumers.

Specific Aims:

- Convene focus groups to identify older adults' preferences for online learning about health. **(Achieved)**
- Develop an interactive online educational program to teach older adults to improve their knowledge and skills in identifying high-quality health Web sites and enhance their ability to efficaciously communicate with their physicians. **(Achieved)**
- Pilot test the feasibility of the program. **(Ongoing)**
- Evaluate the outcomes of the new program compared to an alternative. **(Upcoming)**

2011 Activities: The project team conducted patient focus groups to identify older adults' online learning preferences. Participants were recruited by a community partner through flyers, newsletters, articles in the local newspaper, and mailings. The focus groups were conducted in a flexible semi-structured format to allow participants to bring up topics that matter to them, to build conversation from what other group members discussed, and to allow the moderator to probe for deeper insight into discussions. Questions

focused on Web sites used for health searches, topics of interest, ways to inform older people about the proposed program, the role of friends and families in guiding health information Web searches, and how to evaluate the accuracy of Web-based health information.

Based on the results of the focus groups, the project team developed the content for the Web-based educational program. The goal of the Web site is to present interactive, high-quality information without over simplifying the material or making it overly technical. Two surveys are being created to assess the end-users' perceptions and experiences with the program as compared to the current standard, a non-interactive presentation developed by the NLM.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project budget spending is on target.

Preliminary Impact and Findings: The preliminary findings from the focus groups indicated that the majority of participants use Google as an initial portal for health information. Several participants, upon recommendations from their providers, use sites associated with well-known medical institutions. There was general agreement that participants had no systematic method or criteria for evaluating health information, aside from cross-checking multiple Web sites. Participants agreed that a list of high-quality sites and criteria for evaluating information would be very useful. The overwhelming amount of information on the Web was reported to be a major barrier to effective use. There was near-uniform agreement that an education tool with trial exercises would be beneficial.

The project team compared the findings from patients 55 to 65 years old with patients 65 to 75 years old. The younger group of patients was more interested in a multimedia approach to disseminate health information, an evaluation or feedback component, and supplemental information such as links from the Web site to other resources. Many participants from the younger age group noted that the current Web sites are static and therefore not very engaging. As a result, Dr. Fink has incorporated a more interactive approach to content presentation. Participants from both age groups, regardless of age and education level, were not good at identifying high-quality health information on the Web.

Target Population: Adults, Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Impact of Health Information Technology on Primary Care Workflow and Financial Measures

Principal Investigator:	Fleming, Neil Stewart, M.A., Ph.D., C.Q.E.
Organization:	Baylor Research Institute
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (R03)
Grant Number:	R03 HS 018220
Project Period:	October 2009 – April 2011
AHRQ Funded Amount:	\$99,955

Summary: Little is known about the impact of commercial off-the-shelf electronic health record (EHR) systems on primary care workflow and financial measures, or about the financial and non-financial costs of implementation and maintenance of these systems. Given the goal of universal EHR use in the United States, such knowledge is of immediate and critical importance for the multiple stakeholders in the health care delivery arena.

The HealthTexas Provider Network (HTPN), a large fee-for-service ambulatory care physician network affiliated with an integrated health care delivery system in North Texas, began a staggered 3.5-year roll-out of GE Centricity, an ambulatory EHR system, in mid-2006. Using billing and administrative data, the investigators prospectively examined the impact of the implementation and maintenance of the ambulatory EHR on 26 primary care practices' workflow and financial measures. Investigators also examined the financial resources consumed and the non-financial time and effort costs of the HTPN implementation team and practice physicians, nurses, and office staff preparing for implementation.

The study aimed to better understand frequently-cited perceived barriers to ambulatory EHR adoption, including uncertainty regarding financial and non-financial costs of implementation, loss of productivity during implementation, interference with workflow, and return on investment. Reducing uncertainty in these areas should inform real-world health information technology (IT) implementation decisions and stimulate more comprehensive health IT implementation research in ambulatory care settings.

Specific Aims:

- Estimate the effect of the EHR on workflow outcome measures. **(Achieved)**
- Estimate the effect of the EHR on financial measures. **(Achieved)**
- Quantify financial and non-financial costs of implementation and maintenance, providing information regarding perceived barriers and facilitators to adoption and implementation of the EHR. **(Achieved)**

2011 Activities: The majority of the work on this grant was completed in 2010, including the completion of the last aim. Dr. Fleming and his team used a 3-month no-cost extension to complete the analysis for the first two aims, as well as manuscript and final report preparation. This project was completed April 2011.

Impact and Findings: Results for the third aim were published in the March 2011 volume of *Health Affairs*, "[Financial and Non-financial Costs Associated with Electronic Health Record Implementation](#)"

[in the Primary Care Setting](#).” The analysis takes into account both hardware and software purchases and the time and effort invested in implementation. They estimate the EHR and practice teams spent 611 hours per practice for implementation, and end-users spent 134 hours per physician. For a five-physician practice, implementation cost an estimated \$162,000, with \$85,500 in maintenance expenses during the first year. These results highlight the often hidden costs of EHR implementation, in terms of the time and effort required by individuals at both the leadership and practice level.

Another major concern creating a barrier to EHR adoption is the fear that it is a risky investment that decreases provider productivity and increases practice expenses. In order to assess the impact of the EHRs on productivity, the team examined relative value units (RVUs) and visits per physician full-time equivalent (FTE). RVUs are used to compare the amount of resources required to perform various services between or within an organization’s departments. Work RVUs per-physician FTE did decrease after EHR implementation, representing a drop in productivity. RVUs were 8 percent lower during the first 6 months following implementation, but rebounded to 4 percent lower than pre-implementation levels by 12 months post-implementation. Visits per-physician FTE followed a similar pattern, dropping 8 percent from pre-implementation levels during the first 6 months after EHR implementation, recovering to 4.5 percent lower than pre-implementation after 12 months.

Net income also decreased initially, but after 12 months was not different than pre-EHR levels. Physician expense increased to about \$1,650 per-physician FTE per month, which is approximately the per-physician monthly cost of EHR maintenance costs. While fears of increased expenses and decreased productivity during the initial period after EHR implementation are justified, they are not as large or persistent as thought, with a return to pre-implementation baseline levels after 12 months.

Target Population: Adults, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ’s priority populations.*

Implementation Outcomes of a Health IT Program For Vulnerable Diabetes Patients

Principal Investigator:	Handley, Margaret, Ph.D., M.P.H.
Organization:	University of California, San Francisco
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 020684
Project Period:	July 2011 - June 2012
AHRQ Funding Amount:	\$100,000

Summary: This study is evaluating the Self-Management Automated Real Time Telephone Support (SMART-Steps) Program, which was developed through a previous Agency for Healthcare Research and Quality grant (R18 HS 017261). SMART-Steps used an automated telephone self-management (ATSM) support system to provide monitoring and education diabetic patients enrolled in the San Francisco Health Plan (SFHP). ATSM used health information technology (IT) to help patients self-manage outside traditional ambulatory settings, blending automated pre-recorded telephone queries and education with targeted ‘live’ telephone counseling by care managers. Care managers called if patients responded ‘out of range’ to a query, such as not having checked their blood sugar in the past 7 days. Counseling focused on self-efficacy and self-management skills. The research team is evaluating SMART-Steps Program’s effect on patient-centered outcomes, safety events, and measures from the Healthcare Effectiveness Data and Information Set amongst English-, Spanish-, and Cantonese-speaking diabetes patients. SMART-Steps provides a unique opportunity to examine the real-world implementation process for an evidence-based health IT intervention.

The objective of this study is to describe implementation fidelity—the degree to which the intervention is delivered as intended—for core ATSM intervention components. The core components were: 1) population-based data linkage to determine eligibility; 2) electronic exchange of health information to deliver ATSM queries to patients; 3) electronic integration of health information to identify patients requiring a call-back for an ATSM trigger; and 4) electronic integration of data to identify patients requiring a callback for a medication or laboratory trigger. Additionally, the study will describe the potential impacts of moderating factors, or barriers to implementation fidelity as well as adaptations of ATSM from planned to actual implementation. Moderating factors will include representation of participants versus eligible patients as measured by demographics and baseline clinical measurements, quality of intervention delivery in call-backs, and consistency of delivery over time. The team will review findings and identify adaptations made during implementation to inform future scale-up efforts and create an ATSM implementation guide for dissemination. This information will help interpret results from health IT interventions and guide adaptation and scale-up activities by organizations undertaking similar programs.

Specific Aims:

- Estimate the proportion of patients identified as SMART-Steps-eligible who were ineligible, and describe reasons for ineligibility. **(Achieved)**

- Determine if SMART-Steps patients received ATSM calls with intended frequency (weekly), content (questions/language), and duration (27 weeks). **(Achieved)**
- Estimate the frequency with which electronic exchange for out-of-range triggers (from ATSM and SFHP clinical registry/pharmacy claims) resulted in a documented call-back, in a sample of patients stratified by language. **(Ongoing)**
- Compare SMART-Steps-enrolled to -eligible patients for clinic, age, language, sex, hemoglobin A1c, insulin use, blood pressure, cholesterol, and prior medication non-adherence. **(Achieved)**
- Describe the quality of intervention delivery from care managers call-backs, including frequency of supplemental self-management support, call duration, adherence to protocols, and creation of patient action plans, for a diverse sample of patient triggers. **(Ongoing)**
- Over the course of SMART-Steps implementation, identify differences in average length of callbacks, proportion of call-backs made for triggers, and whether wait-list patients (vs. not) had differential ATSM engagement. **(Upcoming)**
- Summarize fidelity assessment findings, adaptations and implications for real world ATSM implementation and related health IT interventions into a guide, with SFHP partnership. **(Ongoing)**

2011 Activities: The research team's focus in 2011 was on the quantitative and qualitative analysis of the implementation of fidelity of the SMART-Steps Program protocol. They analyzed study enrollment data to determine which patients participated, declined, or were not contacted due to limited resources, including unable to contact or not eligible as determined by screening. Comparison of demographic and clinical characteristics by these groups allowed the study team to look for differences in participation rates. Additionally, an analysis of care manager telephone call records was conducted to determine the frequency with which the care manager was able to speak with the SMART-Steps participant. Finally, the study team conducted interviews with the SFHP staff to identify facilitators and barriers of following the research protocol.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project budget spending is roughly on target.

Preliminary Impact and Findings: To participate in the study, patients needed to meet the following criteria: diabetic, enrolled in the health plan; and English-, Cantonese-, or Spanish-speaking. Patients were screened based on these criteria using the health plan records and the electronic medical record. The SMART-Steps Program was offered as a health plan member benefit, but due to limited resources it was not possible to enroll all members. The analysis of members who declined study participation or were not contacted because of limited resources indicated that there were no differences in demographic characteristics. The call manager telephone data showed that more than 95 percent of calls were correctly delivered. For calls that were not correctly delivered, one reason included calls not going out to newly enrolled participants

The SFHP staff who participated in the interviews reported an overall positive experience with the SMART-Steps Program. The following barriers to protocol fidelity were identified: 1) due to high staff turnover during database development, many people contributed the development process, which resulted in a slightly cumbersome user interface; 2) call managers reported that it was difficult to triage calls;

and 3) due to the structure of the health plan, care managers were required to contact a designated “point person” in clinic if the patient had a serious issue; however, the call managers would have preferred to communicate directly with the provider.

Target Population: Acute Respiratory Infections, Adults, Chronic Care*, Diabetes, Elderly*, Low Literacy, Low-SES/Low Income*, Medicaid, Medically Underserved, Medicare, Racial or Ethnic Minorities*: Cantonese and Spanish-speaking

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Economic Analysis of an IT-Assisted Population-Based Cancer Screening Program

Principal Investigator:	Levy, Douglas, Ph.D., M.P.H.
Organization:	Massachusetts General Hospital
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 020308
Project Period:	March 2011 - August 2012
AHRQ Funding Amount:	\$100,000

Summary: The Massachusetts General Hospital Primary Care Practice-based Research Network (MGPC PBRN) has developed an innovative health information technology (IT) approach that is currently being applied to comprehensive cancer screening. The program, the Technology for Optimizing Population Care in a Resource-limited Environment (TOP-CARE), is using a health IT interface to facilitate the identification, individualized outreach, and subsequent tracking of patients overdue for breast, cervical, and colorectal cancer screening.

This project is looking at TOP-CARE's impact on improvements beyond the use of automated reminders, particularly with regard to its unique outreach strategy, which is based on the provider's individual knowledge of each of his/her patients. More specifically, this is an economic analysis of alternative strategies for improving cancer screening rates in the context of a large provider organization. Utilizing data that was collected during the initial randomized trial on costs, preferences, and clinical and process outcomes, this study will compare increasingly intensive interactions from Baseline Standard of Care (BSC) and Augmented Standard Care (ASC) to the TOP-CARE intervention. For the purpose of this study, BSC refers to visit-based reminders, whereas ASC is defined as a population-level reminder system with automated patient outreach. TOP-CARE is more intense than BCS or ACS due to its individualized outreach approach.

By examining the incremental cost-effectiveness of increasingly intensive interventions, this project will assess the impact of technologically-improved care management in large primary care networks. The analysis will determine the extent to which investments in health IT systems, combined with primary care providers' unique knowledge of their patients, yield improvements in breast, cervical, and colorectal cancer screening rates. Ultimately, the study will help determine whether ASC and TOP-CARE interventions are worth the additional investment in health IT and physician time. Evaluating the efficiency of health IT-assisted population-based care is essential to ensuring it is a strategy that can be disseminated broadly.

Specific Aim:

- Evaluate the marginal cost per patient screened of the TOP-CARE and augmented standard care programs compared to baseline standard care from an ICO perspective. **(Ongoing)**

2011 Activities: In order to achieve the project aim, the study team has established five milestones: 1) gathering wage data; 2) developing BSC estimates from surveys; 3) developing time use estimates from survey data and direct observation for the TOP-CARE intervention and ASC; 4) developing software cost estimates; and 5) conducting the cost-effectiveness and sensitivity analyses. The focus during 2011 was on the milestones related to gathering wage data and developing the BSC and time estimates.

In their effort to gather wage data, the study team worked closely with the TOP-CARE staff to assess all active users of the system, including primary care physicians, nursing staff, medical assistants, patient coordinators and secretaries, and administrative staff. While all providers have been identified, the team continues to identify all the patient navigators who are using the system. Wage data for the intervention staff has been obtained and cost estimates are being calculated based on the average wage for each job class applied to the average daily cost of time devoted to cancer screening activities during BSC.

To determine the BSC estimates, the study team has identified the variables necessary for cost analyses, including the nature of the data and whether it would be available from current data systems. Information that will require survey methodology was identified. The survey instrument for primary care physicians, practice delegates, and navigators was developed, as well as a strategy to field the surveys to all TOP-CARE clinical personnel. The survey was administered in paper form to primary care providers and practice delegates during initial meetings and training sessions. Providers who were not present during the initial meeting or who did not turn in a completed survey were subsequently sent an electronic version and another paper copy. The survey will be re-administered at the completion of the study.

Time estimates for using the intervention and ASC are being established by evaluating the personnel time use by health IT personnel, physicians, case managers, delegates, and patient navigators. Training sessions on how to use the system were conducted beginning in May 2011 and health IT staff documented the time spent in initial training sessions and followup training sessions to reflect part of the implementation costs of TOP-CARE. The staff is also documenting time spent on additional support and training activities on an ongoing basis. Direct observation of system users will occur in the near future.

As last self-reported in AHRQ's Research Reporting System, the project progress and activities are on track and project budget spending is on target.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Cancer

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Synthesizing Lessons Learned Using Health Information Technology

Principal Investigator:	Nemeth, Lynne, M.S., Ph.D.
Organization:	Medical University of South Carolina
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality through Health Information Technology (IT) (R03)
Grant Number:	R03 HS 018830
Project Period:	May 2010 – April 2012
AHRQ Funding Amount:	\$99,861

Summary: Over the past decade, the Practice Partner Research Network (PPRNet), a practice-based research network consisting of more than 224 physician practices, has established a theoretically-informed framework for translating research into practice (TRIP) in small- to medium-sized primary care practices that use the Practice Partner® electronic medical record (EMR). The PPRNet-TRIP Quality Improvement (QI) model has three components: an intervention model, an improvement model, and a practice development model that assists practices with implementation of QI measures.

This project is conducting an evaluation of the mixed-methods data and lessons learned from a decade of PPRNet-TRIP research. The experience of PPRNet research participants and researchers will enhance understanding of the PPRNet-TRIP components and how they can improve primary care quality. The cross-case analyses conducted through this research will generate important themes, provide new insights, and generate new hypotheses about factors that improve the quality of care through the use of EMRs.

Each project is being reviewed individually for new interpretations and previously unidentified concepts. All source data for each project will be embedded into NVivo 8.0 – qualitative data analysis software – for analyses. Dr. Nemeth and her research team will read the full set of data for each project using each whole document or component, and will re-read and code.

Using the new insights developed through the secondary analysis across all the studies, a semi-structured interview guide will be developed in collaboration with the PPRNet research team and the expert advisory panel to examine the perspectives of practice participants who have been engaged in previous PPRNet research. This interview guide will be cognitively pre-tested with a small sample of practice participants to ensure that the meanings of the questions are understood and that participants can articulate what the questions mean. Participants for the interviews on sustainability, maintenance, and team development will be recruited from PPRNet practices that have participated in past studies.

Finally, by identifying the patterns transcending the individual projects, the project team will refine and validate the PPRNet-TRIP QI model and its three components. Using the combined observation data from practice site visits, group and individual interviews with practice participants, interactions of practice liaisons at best-practice network meetings, and ongoing correspondence in conjunction with quantitative practice performance data on the specific measures related to each particular study, this project will identify strategies implemented and the barriers and facilitators of QI efforts by practices using EMRs. The secondary analyses of the primary findings in a context separate from the individual

study, using “immersion and crystallization,” will allow new interpretations and learning about how the research team and the primary care practices within the research network have evolved to improve quality while implementing health information technology.

Specific Aims:

- Complete a mixed-methods secondary analysis to synthesize findings related to improving quality using health information technology in primary care across seven nationally-funded PPRNet initiatives. **(Achieved)**
- Examine current perspectives of PPRNet-TRIP study practice participants related to developing and sustaining QI efforts and team development for an increasingly active health care delivery role through robust EMR implementation. **(Ongoing)**
- Integrate findings from PPRNet’s previous studies with the current perspectives of practice representatives to refine the overarching theory-based PPRNet-TRIP QI model. **(Ongoing)**

2011 Activities: A preliminary refinement of the PPRNet-TRIP QI model resulted in the 12 initial concepts being reduced to four overarching themes that reflect the evolution of practice transformation using health information technology (IT) to improve quality: 1) developing a care practice team; 2) adapting and using health IT tools; 3) transforming the practice culture and quality; and 4) activating patients.

The refined model concepts have established internal validity and four practices provided evidence to support that this model adds to the learning and development of their practices while using health IT to improve quality. As the interviews are completed and analyzed, additional refinement of the model will occur.

The four concepts exemplified in the synthesized model continue to hold validity, and have streamlined two previous models to create a reference for the key steps involved in practice transformation for improving quality using health IT. Data analysis from discussions with practice members confirmed that there are variations in how this is implemented but the broad categories hold true. Continued evaluation with this model will ensure saturation of these concepts and that no premature conclusions are finalized.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and the project budget spending is roughly on target.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

Electronic Medication Management

Principal Investigator:	Vawdrey, David Kent, M.S., Ph.D.
Organization:	Columbia University Health Sciences
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality Through Health Information Technology (R03)
Grant Number:	R03 HS 018250
Project Period:	December 2009 – September 2011
AHRQ Funding Amount:	\$99,998

Summary: When patients transfer to new health care settings, there is an increased risk of medication errors due to incomplete or inaccurate medication information. These discrepancies can be harmful. To decrease such errors, policymakers such as the Joint Commission have focused on improving the quality of medication list documentation and communication through the process of medication reconciliation. Medication reconciliation employs a systematic approach to comprehensively review all of a patient’s medications at each care transition and compare them to what is ordered for the patient in order to identify and resolve medication discrepancies.

In 2008, the New York-Presbyterian (NYP) Healthcare System instituted a structured, electronic process designed to improve medication reconciliation as patients transitioned between ambulatory-to-hospital and hospital-to-ambulatory care settings. Before the adoption of this intervention, pre-admission medications and discharge medications were kept as free-form text in the patient’s electronic health record (EHR). After adoption, medications were documented using the Outpatient Medication Profile (OMP), a structured, longitudinal electronic medication list shared across NYP’s ambulatory and inpatient EHRs. When a patient was admitted to the hospital, the OMP was updated by verifying existing entries and adding new medications that the patient was taking. A medication reconciliation view was created within the EHR that displayed two columns: 1) the list of the current inpatient medication orders; and 2) the list of outpatient medications from the OMP. From this screen, a provider could identify discrepancies between the lists and update the inpatient orders accordingly. Once finished, the provider attested that medication reconciliation was complete by clicking a checkbox. A medication reconciliation reminder in the inpatient EHR was implemented so that a reminder dialog was displayed when placing orders in the computerized provider order-entry system if attestation of medication reconciliation had not been completed within 6 hours of hospital admission. If the attestation had not been completed by 18 hours after admission to the hospital, a “hard-stop” dialog was displayed and no orders could be placed until attestation was documented.

This study evaluated the effectiveness of the electronic medication reconciliation intervention by comparing outcomes pre- and post-implementation in six community-based primary care clinics and two inpatient facilities.

Specific Aims:

- Assess differences in medication management workflow in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Achieved)**

- Assess differences in the completeness of documented medication lists in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Achieved)**
- Assess differences in the rate of clinically important medication discrepancies in two provider cohorts before and after the adoption of electronic medication reconciliation. **(Achieved)**

2011 Activities: Data were obtained retrospectively from six community-based primary care clinics and two inpatient facilities that adopted the electronic process for medication reconciliation at hospital admission using the OMP. Dr. Vawdrey and the project team examined medication lists in free-text clinical documents to determine the harm potential for missing information about the name, dosage, route, or frequency of a medication. For medication lists that were incomplete, they evaluated the harm potential associated with the missing information. Electronic notes authored over a 2-year period were collected for a random sample of 100 patients who had the following sequence of consecutive clinical encounters: an outpatient visit, an inpatient admission, an inpatient discharge, and a second outpatient visit. Each encounter was expected to generate a note, for a total of four notes per patient.

Each clinical note was reviewed to identify a medication list within the note, and each medication list was categorized as “complete” or “incomplete.” Medication lists deemed incomplete were independently reviewed and categorized as “potentially harmful” or “low harm potential” by three experienced physicians. The physician reviewers were instructed to classify each incomplete medication list as “potentially harmful” if, in the opinion of the reviewer, the information missing from the list could lead to a prescribing error. If the missing information could likely be inferred by a practitioner with a similar background, then the medication list was classified as “low harm potential.” Inter-rater agreement was calculated; if the three reviewers were not unanimous in their classifications, the classification chosen by a majority of the reviewers was used.

During the compilation of the medication lists for the study, it was observed that many lists contained comments or annotations separate from the dose, route, and frequency information. This observation prompted a secondary qualitative analysis of the medication lists based on a grounded theory approach.

During the year, Dr. Vawdrey and his team continued to disseminate the results of the project, including a presentation, [Evaluation of Medication List Completeness, Safety, and Annotations](#) at the 2011 Annual Symposium of the American Medical Informatics Association in October, and a published manuscript, [Use of Electronic Clinical Documentation: Time Spent and Team Interactions](#) in the *Journal of the American Medical Informatics Association*.

Dr. Vawdrey used a 1-year no-cost extension to complete the project, which ended in September 2011. Dr. Vawdrey did not submit a report in the AHRQ Research Reporting System during 2011 with a status of activities or project spending.

Impact and Findings: Before the electronic medication reconciliation process was adopted, the average number of medications contained in the OMP for a patient at hospital admission was less than two. One year after adoption, the average number had increased to 4.7. Of 253 medications lists reviewed, 181 lists (72 percent) had at least one medication missing a dose, route, or frequency. Missing information was judged to be potentially harmful in 47 of 253 lists (19 percent).

Before the reminder intervention, the mean duration between hospital admission and attestation of medication reconciliation was 84.5 hours (median= 9.1 hours). After the reminder intervention, the mean duration between hospital admission and attestation of medication reconciliation was 9.2 hours (median= 5.3 hours).

Target Population: Inner City*, Low SES/Low Income*, Medicaid, Medically Underserved, Racial/Ethnic Minorities*: Hispanic

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Improving Outpatient Medication Lists Using Temporal Reasoning and Clinical Texts

Principal Investigator:	Zhou, Li, M.D., Ph.D.
Organization:	Brigham and Women's Hospital
Mechanism:	PAR: HS08-268: Small Research Grant to Improve Health Care Quality Through Health Information Technology (R03)
Grant Number:	R03 HS 018288
Project Period:	October 2009 – September 2011
AHRQ Funding Amount:	\$99,949

Summary: An accurate and complete medication list in a patient's electronic health record (EHR) is critical to prevent medication prescribing and administration errors. Most software systems aggregate structured medication data from the EHR to generate and maintain a reconciled list. However, certain critical information for medication reconciliation and decision support exists in free-text clinical notes that may be unavailable in structured data. Structured data in a standard, predictable form can be processed easily by a computer, but narrative data are not codified and thus pose challenges. Natural language processing (NLP) is any system that manipulates free-form text or speech. NLP applications have been developed to identify and extract medical information from non-structured sources, but few projects have examined the use of NLP as a method for improving the accuracy of medication lists and facilitating medication reconciliation.

One challenge for medication reconciliation is that the drug names from various EHR applications and NLP systems are usually coded using different terminologies (e.g., a local terminology for a specific organization or a commercial terminology) and therefore not interoperable. This study investigated the feasibility of extracting medication information from non-structured electronic clinical sources within the Longitudinal Medical Record (LMR) system, the ambulatory care EHR at Partners HealthCare System. The extracted information can be used by clinicians at the point of care to reduce prescription and administrative errors. This project: 1) designed and developed an NLP application that identifies medication names and drug signatures (e.g., dose amount) and other contextual information (e.g., status) from free-text clinical notes; 2) encoded medication names using RxNorm and local terminology in the LMR; 3) conducted terminology mapping simultaneously; 4) structured the extracted information; 5) evaluated the tool by verifying the NLP output against manual review; and 6) identified requirements for a user interface to use NLP output for efficient medication reconciliation.

Specific Aims:

- Extract and encode medication information from clinical texts available in an ambulatory electronic medical record system. **(Achieved)**
- Apply temporal information (a controlled terminology, domain knowledge, and linguistic knowledge) to develop a mechanism to represent the timing of medication use, detect the changes, and then to organize medications in a chronological order and classify them into appropriate groups. **(Achieved)**

- Measure the feasibility and efficiency of the proposed methods and tools for improving the process of medication reconciliation. **(Achieved)**

2011 Activities: Dr. Zhou and her project team completed the development of the NLP system at the beginning of the year. The system, called the Medical Text Extraction, Reasoning and Mapping System (MTERMS), applies a modular, pipeline approach flowing from a preprocessor to a semantic tagger, a terminology mapper, and a context analyzer to a parser. It extracts free-text medication information (e.g., drug name, dose, and frequency), encodes drug names using different terminologies, and establishes dynamic mappings between them to improve data interoperability.

Thereafter, the project team evaluated the performance of MTERMS in processing medication information from clinical free-text documents. They focused on free-text outpatient clinical notes created mainly by patients' primary care physicians and medical specialists. Evaluators manually reviewed and compared 30 free-text and 10 structured outpatient notes with MTERMS output. The mapping between RxNorm and a local medication terminology in the LMR was also assessed, and requirements for integrating NLP output to the medication reconciliation process were studied.

Dr. Zhou and her team disseminated the results of the project in [Using Medical Text Extraction, Reasoning and Mapping System \(MTERMS\) to Process Medication Information in Outpatient Clinical Notes](#), an article in the Proceedings of 2011 Annual Symposium of the American Medical Informatics Association, and in [Mapping Partners Master Drug Dictionary to RxNorm using an NLP-based Approach](#), which was published in the *Journal of Biomedical Informatics*.

As last self-reported in the AHRQ Research Reporting System, project progress and activities were on track and project budget spending was on target. The project was completed in September 2011.

Preliminary Impact and Findings: Dr. Zhou and her team found that real-time clinical use of NLP in assembling the medication reconciliation list is feasible. However, a real-life application will require change management. For example, a terminology management process to review how updates to terminologies will affect the mappings and to track retired concepts is needed. A common occurrence in electronic order entry systems is free-text medication entries, which represent something of a 'black box' to the systems that process them. NLP could be used to extract coded medications from these entries and allow duplication alerts or a drug interaction system to catch potential medication errors.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Impact of Health IT Implementation on Diabetes Process and Outcome Measures

Principal Investigator:	Ballard, David J., Ph.D., M.D., M.S.P.H.
Organization:	Baylor Research Institute
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT)(R21)
Grant Number:	R21 HS 020696
Project Period:	June 2011 - May 2013
AHRQ Funding Amount:	\$299,985

Summary: Diabetes is an increasingly common chronic disease that requires long-term management. Currently, the health care provided to patients with diabetes falls short of the “best care” practices established in evidence-based clinical guidelines. The primary objective of this observational study is to quantify the effects of a commercially-available ambulatory electronic health record (EHR) on quality of diabetes care, as measured by compliance with recommended processes of care and patient outcome measures. The EHR includes diabetes care prompts and a diabetes management form (DMF), a condition- specific documentation tool that integrates data review, real-time evidence-based clinical decision support, order entry, and patient education.

The study is being conducted in the Baylor Health Care System HealthTexas Provider Network, which staggered implementation of the EHR in practices between 2006 and 2008. The primary aim is to test the impact of the EHR on the care of diabetes patients using the Health Partners “Optimal Diabetes Care” composite measure with retrospective chart audit data. This composite measure includes hemoglobin A1c (HbA1c), cholesterol, blood pressure, patient age, and smoking status. Secondary aims include testing the impact of the EHR on patient outcomes and compliance with recommended processes of diabetes care, estimating the prevalence of voluntary physician use of the DMF embedded within the EHR, and determining the effect of DMF use on patient outcomes.

This study will provide important information about the potential for an EHR to improve quality of diabetes care, including insight regarding the potential of and need for disease-specific EHR components to effect improvement.

Specific Aims:

- Estimate the impact of an EHR on diabetes outcomes, measured by the proportion of patients meeting the Health Partners Optimal Diabetes Care measure. **(Achieved)**
- Estimate impact of an EHR on specific patient outcomes and compliance with recommended process of care related to diabetes. **(Achieved)**
- Estimate the prevalence of physician use of the Diabetes Management Form, and the effect of the Diabetes Management Form on patient outcomes related to diabetes as measured by the Optimal Diabetes Care measure. **(Ongoing)**

2011 Activities: During the first 6 months of the project, funded in June 2011, Dr. Ballard and his team focused on evaluating the impact of the EHR on processes and outcomes of diabetes care (the first two aims). The analyses for these two aims were complete by the end of August, having benefitted from prior experience with the dataset. The dataset had been prepared and cleaned prior to the start of this project period for other purposes, including operational quality improvement work. The data were collected from the Baylor Health Care System HealthTexas Provider Network medical record (Centricity). The research team wrote a manuscript describing the results for these first two aims, titled [The Effectiveness of Implementing an Electronic Health Record on Diabetes Care and Outcomes](#), and published by *Health Services Research* in January 2012.

During the second half of the year, the research team focused on the third aim, which included the development of a process for linking two separate datasets: 1) data generated over the past 5 years that documents (through review of paper and electronic text) and populates pre-defined fields and measures focused on diabetes care; and 2) data from the DMF that is part of the EHR. By the end of the year, the research team linked the two datasets and began to examine the relationship between use of the DMF and patient process and outcome data.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track and project budget spending is on target.

Preliminary Impact and Findings: After adjusting for patient age, sex, and insulin use, patients exposed to the EHR were significantly more likely to receive optimal care when compared with unexposed patients. Components of the optimal care bundle showing positive improvement after adjustment were systolic blood pressure <80 mmHg, diastolic blood pressure <130 mmHg, aspirin prescription, and smoking cessation. Among patients exposed to the EHR, all process and outcome measures except HbA1c and lipid control showed significant improvement.

Target Population: Adults, Chronic Care*, Diabetes

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Text Messaging to Improve Hypertension Medication Adherence in African Americans

Principal Investigator:	Buis, Lorraine, M.S.I., Ph.D.
Organization:	Wayne State University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019092
Project Period:	September 2010–September 2012
AHRQ Funding Amount:	\$172,260

Summary: Hypertension is the leading cause of cardiovascular disease worldwide. Chronic hypertension is particularly burdensome for African Americans because they are more susceptible to the condition than other racial groups. Despite evidence that hypertension medications can reduce the risk of myocardial infarction and stroke, only about half of patients who have been diagnosed with hypertension in the United States adhere to those regimens.

Mobile phones and text messages are becoming widely integrated into daily life and may offer a simple and less labor-intensive way to enhance medication adherence. This project is developing and testing an automated text message system to improve medication management by helping individuals self-monitor adherence through reminders. It is theorized that individuals who use a mobile phone-based automated text message system will have improved medication adherence, medication self-efficacy, and blood pressure control. The system will assess African Americans with uncontrolled hypertension on medication adherence, medication self-efficacy, and blood pressure measurements from baseline to 1-month followup, and will also track participant perceptions of intervention effectiveness and satisfaction.

Specific Aims:

- Utilize patient participant feedback in the development of a mobile phone text message system to improve adherence to antihypertensive medications. **(Achieved)**
- Understand the effect of the newly-developed text message system on changes in medication adherence, medication self-efficacy, and blood pressure from baseline to 1-month followup in African Americans with uncontrolled hypertension. **(Ongoing)**
- Assess participant perceptions of intervention effectiveness and satisfaction in order to guide further system refinement. **(Upcoming)**

2011 Activities: At the start of the year, the project team conducted three focus groups. Inclusion criteria for the focus groups were African American, hypertension as documented in the electronic medical record, cell phone ownership, and under-active treatment. Based on the results of the focus groups, Dr. Buis and her team developed a text messaging system that provides patients with customizable adherence reminders as well as educational messages about high blood pressure, nutrition, and physical activity. The system underwent robust testing to ensure that all of its components functioned properly. System tests confirmed that text messages were properly sent and received. Automated processes were

reviewed to ensure that the system was able to process different data structures and that the customizable features functioned as designed. An interface was developed to collect baseline and follow-up data, including demographic and clinical characteristics. The system will then be evaluated in a randomized controlled trial.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is roughly on target.

Preliminary Impact and Findings: Analysis of the focus groups indicated that despite high self-reported adherence to medications, participants do not always take their medications as prescribed. Additionally, the focus groups confirmed that the vast majority of participants had previously used text messaging. While all participants indicated that they were in favor of a text message approach to improving medication adherence, they overwhelmingly stated that they did not want to use texting to report adherence after each dose or on a daily basis. The majority of participants wanted to receive daily reminders to take their medications with the option of customizing the time that texts are sent as well as the number of reminders. In addition, many participants reported that they are interested in receiving occasional health promotion or educational messages related to high blood pressure, nutrition, and physical activity. These findings contributed to the design of the automated text message intervention, which is now being evaluated in a small randomized controlled trial.

Target Population: Adults, Hypertension, Racial or Ethnic Minorities*: African American

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Supporting Continuity of Care for Poisonings with Electronic Information Exchange

Principal Investigator:	Cummins, Mollie Rebecca, M.S.N., Ph.D.
Organization:	University of Utah
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21)
Grant Number:	R21 HS 018773
Project Period:	March 2010 – February 2013
AHRQ Funding Amount:	\$299,078

Summary: Exchange of information between poison control centers (PCCs) and emergency departments (EDs) is conducted almost entirely by telephone. In these high-volume and often chaotic settings, however, reliance on verbal communication increases the potential for data loss, delayed time to treatment, and medical error. The electronic exchange of information could improve continuity of care for poisonings, reduce time-to-treatment and medical errors, facilitate communication and availability of data to clinicians at the point of care, and ensure timely followup.

This project identified the data requirements for electronic information exchange between PCCs and EDs to support individual patient care and care transitions. The team is describing current information exchange scenarios as well as important clinical, operational, and legal considerations. The project team is using multiple approaches, including interviews with clinicians and stakeholders, document review, analysis of recorded PCC calls, storyboarding, as well as a four-round Delphi study to determine consensus among national experts on significant clinical, operational, and legal considerations.

The results of this study will provide concrete guidance for efficient research and development on PCC-ED information exchange, including information technology solutions, standards adoption or development, and policy. Long-term implications include the study of outcomes, quality improvement innovations, and the potential for computerized decision support.

Specific Aims:

- Describe information requirements for electronic information exchange between PCCs and EDs. **(Ongoing)**
- Describe current data and information exchange scenarios between a regional PCC and an ED. **(Ongoing)**
- Identify salient clinical, operational, and legal considerations related to electronic exchange of data and information between PCCs and EDs. **(Achieved)**

2011 Activities: The research team completed a four-round modified Delphi study to identify the clinical, operational, and legal considerations important for electronic information exchange between EDs and PCCs at the end of 2010. The team's focus in 2011 was on analysis, manuscript development, and dissemination of these considerations. Results of the modified Delphi study were presented at the Society for Academic Emergency Medicine's 2011 annual meeting in June, the North American Conference on

Clinical Toxicology in September 2011, and the annual meeting of the American Medical Informatics Association in October 2011.

In addition, work continued on analyzing the PCC to ED call recordings. This included the time to identify, merge, clean, and transcribe the audio files before data analysis. Dr. Cummins and her team originally analyzed 60 calls and have sampled an additional 40 calls in 20-case increments. Analysis is ongoing. The project team will continue to sample in 20-case increments until they achieve saturation of information (e.g. no new types of data or information). Thus far, 120 unique data/information types have been identified.

In the original grant proposal, Dr. Cummins had proposed to inventory the types of information exchanged, but during call analysis the research team also found many examples of inefficient data processes and poor data quality. The team decided to develop a taxonomy of the types of data process inefficiencies and poor data quality and went back and noted frequencies in order to more fully describe the data exchange process. The additional analysis provides valuable information about the nature and frequency of inefficiencies and poor data quality, inherent in the current verbal information exchange process.

The team has begun interviews with ED providers (physicians and nurses) from Intermountain Medical Center and Primary Children's Medical Center, as well as poison-control specialists to identify current/ data information exchange and user needs related to information exchange. Twelve of an estimated 18-to-24 interviews have been completed. The team has started to develop the process diagrams depicting the sequence of information exchange, and will finish the interviews by showing the diagrams to the interviewees to get validation of the process.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is on target. Due to the added task of the taxonomy of the types of data processes and data quality, as well as the unanticipated amount of time it took to prepare the audio files for analysis, Dr. Cummins is using a 1-year no-cost extension to complete the call analysis and the storyboards to describe the exchange scenarios.

Preliminary Impact and Findings: The response rate for the modified Delphi study was high and stable. Upon completion of the fourth round, 115 of 122 statements had reached consensus. Panelists agreed upon the importance of most outcomes including effects on communication, information availability for decisionmaking, and medical error. They also agreed upon key aspects of adoption and implementation, and favor systems that support but do not replace verbal communication and consultation.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Improving Meaningful Access of Internet Health Information for Older Adults

Principal Investigator:	Czaja, Sara, Ph.D., M.S.
Organization:	University of Miami
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21)
Grant Number:	R21 HS 018831
Project Period:	April 2011 – September 2012
AHRQ Funding Amount:	\$231,476

Summary: There has been enormous growth in the development of consumer-oriented health information technology (IT) applications designed to support tasks such as the exchange of health information, communication, health decisionmaking, and disease management. These applications are intended to support the delivery and self-management of health care and ultimately improve health outcomes. Data suggest that the usability and utility of many consumer health IT applications that are available on the Internet, such as health Web sites, are uneven across user groups.

This is especially true for older adults whose age-related cognitive changes can impair their ability to find information on the Internet. Many older adults have less experience with computers and the Internet than other age groups. Finding, using, and discerning the reliability of Internet health information, as well as integrating and interpreting the wealth of information available, may be challenging for older people. In fact, when compared to younger adults, older adults report more anxiety about technology adoption. Studies have shown that older adults use less-efficient search strategies and have less success finding specific information than do younger adults. Given our aging population and the fact that older adults represent a large segment of the consumer health population, it is important to consider and identify ways to reduce barriers to access and use health IT applications by older adult consumers when implementing health IT applications.

This study is refining four existing cognitive aiding tools that are designed to help individuals filter, integrate, and interpret Internet health information. The refinement process is intended to enhance the usability of the tools to support effective use of health IT applications by older adult consumers. Dr. Sara Czaja and her research team at the University of Miami Miller School of Medicine is collaborating with the Palo Alto Research Corporation to conduct this two-phased study.

In Phase I, the research team is conducting an iterative tool-refinement process that began with a detailed task analysis of the tools to inform initial refinement. A series of focus groups involving older adult users and clinicians who work with older adults and underserved populations was conducted to provide a preliminary assessment of the usability of the tools. Findings from the focus groups informed additional refinements to the tools. A second cycle of usability testing of the refined tools will be completed in 2012.

During the second phase of the study, the tools will be formally evaluated with a randomized study comparing “aided” to “unaided” adults 30 to 85 years of age. Both groups will receive general practice on Internet searching, while participants assigned to the “aided” group will also receive training and

practice on each of the four refined cognitive aiding tools. Subsequently, both groups will be assigned scenarios and problem-solving tasks to complete. The “aided” group will have access to the four tools to assist in completing the tasks; the “unaided” group will not. The feasibility, acceptability, and usability of the aiding tools and their impact on the performance of Internet-based health management tasks will be evaluated by measuring information-seeking performance, domain knowledge, tool use, and usability of the tools. This project will obtain information on the influence of individual characteristics such as age, cognitive abilities, and health literacy on information-seeking performance and the perceived usability and use of the tools. Ultimately, the tool refinement process and tool evaluation findings will be used to develop a set of tools that are easy to use and support effective use of e-health applications by older adult health care consumers.

Specific Aims:

- Refine, through a user-centered iterative design process, a set of software aiding tools so that they can be used by health consumers, particularly older adults, in the performance of Internet-based health management tasks. **(Ongoing)**
- Evaluate the feasibility, acceptability, and usability of these tools among adult health consumers and the impact of the use of these tools on the performance of Internet-based health management tasks. **(Upcoming)**

2011 Activities: The four aiding tools have undergone initial testing and refinement, first by a task analysis in which the research team reviewed, evaluated, and modified the tools accordingly. Subsequently, an initial usability assessment was conducted by holding a series of focus groups with older adults, the findings from which led to additional revisions and design changes to the four tools to enhance usability. Final refinements are being made, and the formal evaluation tool study will be initiated in 2012.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track, and project budget spending is roughly on target.

Preliminary Impact and Findings: Findings from the focus groups conducted as part of the user-centered iterative design process indicate that the four tools are helpful and that older adults would use them.

Target Population: Adults, Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

An Automatic Notification System for Test Results Finalized After Discharge

Principal Investigator:	Dalal, Anuj K., M.D.
Organization:	Brigham and Women's Hospital
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 018229
Project Period:	January 2010 – March 2012
AHRQ Funding Amount:	\$294,052

Summary: This project is creating an automated system to notify physicians, via secure email, patients' test results pending at discharge (TPADs). The system is designed to facilitate communication and acknowledgement of test results by responsible inpatient and ambulatory physicians during care transitions. The study team will evaluate the system's impact on physicians' awareness of test results.

In the first phase of this study, components of the system were developed to: 1) identify tests with results pending at the time of discharge; 2) obtain the identity and email addresses of the responsible inpatient and ambulatory providers; 3) exclude routinely-ordered tests to avoid provider alert fatigue; and 4) automate notification to providers by email once results are available. The intervention relies primarily upon the inpatient clinical information system; the admission, discharge, and transfer systems; and network email to orchestrate the series of events that lead to the automated notification of final test results after discharge.

In the second phase, a cluster-randomized, 6-month controlled trial measured the impact of this system on physicians' awareness. The study participants were 450 patients who were discharged from the inpatient general medicine and cardiology services at Brigham and Women's Hospital (BWH). Staff randomized both the responsible inpatient provider (attending physician at time of hospital discharge) and the responsible outpatient provider (the patient's primary care physician [PCP]) prior to the intervention. The study population included patients with TPADs discharged from these services if both their inpatient attending and primary care physician were randomized to the either intervention or usual care. Patients were excluded if their inpatient attending and PCP were in discordant arms or if their inpatient attending and PCP were the same person.

The primary outcome is awareness of any TPAD result by the inpatient attending. Secondary outcomes include awareness of any TPAD result by the PCP, user satisfaction, awareness of actionable test results, and whether appropriate actions are taken in response to these results after EHR review. Physician awareness is measured by a survey sent to responsible providers 72 hours after the last finalized TPAD result is available. The study will inform future efforts to optimize this type of intervention at BWH and other institutions trying to minimize this patient safety problem.

Specific Aims:

- Create an automatic notification system to prompt physicians of test results finalized after discharge. **(Achieved)**

- Evaluate the impact of this system on physician awareness of test results finalized after discharge.
(Ongoing)

2011 Activities: Microbiology test types were activated. The randomized controlled trial (RCT) continued during this period, and the project achieved target enrollment of 450 subjects, thereby concluding the RCT at the end of May 2011. The research team began cleaning the final data set for analysis, compiling a list of patients for the exploratory analysis of downstream actions, and preparing preliminary drafts of manuscripts describing the innovation. The project team anticipates completing all aspects of the project by the end of the 9-month no-cost extension period.

As last self-reported in the AHRQ Research Reporting System, progress is completely on track and project budget spending is on target.

Preliminary Impact and Findings: An interim analysis of the data showed promising results. Inpatient attending and PCP satisfaction with the new automated email notification system was high. Those physicians receiving usual care reported lower satisfaction with existing systems of managing TPADs. Both inpatient attending and primary care physicians reported higher awareness of test results finalized after discharge: 72 percent and 56 percent, respectively. The inpatient attending and PCP in the control group both reported lower awareness, at 34 percent each.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

eHealth Blood Pressure Control Program

Principal Investigator:	Eaton, Charles B., M.D., D.A.B.F.P., M.S.
Organization:	Memorial Hospital of Rhode Island
Mechanism:	RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (R21)
Grant Number:	R21 HS 018238
Project Period:	December 2009 – September 2012
AHRQ Funding Amount:	\$299,967

Summary: Researchers at Memorial Hospital of Rhode Island have designed a two-phase study of the feasibility and acceptability of an e-health model for the treatment of hypertension. The study, the eHealth Blood Pressure (eBP) Control Program, integrates electronic medical records (EMRs) and personal health records (PHRs) with monitoring devices through a Web portal that connects patients to their medical team. The goal of the project is to obtain the necessary pilot data for a randomized clinical trial of the eBP Control Program.

The program strives to improve patients' blood pressure (BP) control by increasing medication adherence and reducing clinical inertia. It also seeks to improve patient education, collaborative self-management support, and care coordination. In phase one of the study, the research team developed and field-tested a PHR, a BP self-management Web portal, and training materials for a patient navigator. Additionally, the team integrated a home blood pressure monitoring (HBPM) device into the PHR. During phase two, the team will enroll 30 patients with uncontrolled BP. For the first 3 months of phase two, all 30 patients will use a single component of the intervention program: HBPM. After 3 months, the participants will be randomized to the three-component program (HBPM + PHR + Web portal) or the three-component program plus a patient navigator.

Specific Aims:

- Develop and refine a Web-based patient-centered decision support system for BP control using an iterative, user-centered design process so that it meets standards of feasibility and acceptability for patient navigators and participants. **(Achieved)**
- Determine the appropriate and acceptable patient motivators (i.e., engaging content, social media, and incentives) leading to use of the eHealth BP control program (BP device, PHR, Web portal, patient navigator). **(Ongoing)**
- Develop and begin to field-test a patient navigator training program, a manual of procedures for the patient navigators, and a measure of patient navigator adherence to the training manual. **(Achieved)**
- Test the functionality, security, and fidelity of the secure data exchange between the HBPM device, PHR, Web-based portal, and EMR interface engine in both test and live (enterprise) environments. **(Achieved)**
- Determine the degree of adoption by participants of the four intervention components (HBPM, PHR, Web portal, patient navigator). **(Ongoing)**

- Estimate the effect sizes of the four-component program relative to the three-component program with regard to patient activation, self-care activities, medication adherence, reduced clinical inertia, and improved BP control with implementation of the eBP control program. **(Upcoming)**

2011 Activities: The open trial of the eBP Control Program was underway. Beginning in 2010, participants were recruited through letters sent to the homes of potentially eligible patients. Additionally, a ‘pop-up’ alert in the EMR flagged potentially eligible patients. By December 2011, 28 patients had been enrolled. Thirteen patients were randomized to the patient navigator arm; 12 to the no patient-navigator arm; and three dropped out before randomization. Of patients who were randomized, 13 completed the study, seven continue to participate in the study, and five dropped out after randomization. Reasons for drop out included loss to follow-up and technical issues with the BP cuff. In some instances, the BP cuff did not properly fit patients, which led to an error message. Dr. Eaton discussed this issue with the BP cuff vendor, who is receptive to making modifications to future versions of the cuff. As patients progress through the study, the research team assists them with any technical issues. A few patients, for example, did not have the technical literacy to setup the required software, so the research team helped guide them through the process.

The patient navigators continue to meet regularly with a clinical psychologist to discuss questions and concerns related to patient interactions. During these meetings, the peer navigators and the clinical psychologist review the audio recordings from the navigators’ meetings with patients and discuss how to handle new or difficult situations. The meetings also offer an opportunity to ensure fidelity to the study protocol, including ensuring that the peer navigators provide emotional support while being careful not to offer clinical advice.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is roughly on target.

Preliminary Impact and Findings: Preliminary results from patient exit interviews indicate that study participants believe this is an important study, that participants liked meeting with the patient navigator, and that they would recommend the eBP Control Program to a friend or family member. Participants reported frequent use of the BP tracking feature of the PHR. While participants were aware of the other resources on the Web site, those did not access them frequently. Dr. Eaton is writing a manuscript that summarizes these results.

Target Population: Adults, Hypertension, Low Literacy, Medically Underserved, Safety Net

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

NICU-2-HOME: Using Health IT to Support Parents of NICU Graduates Transitioning to Home

Principal Investigator:	Garfield, Craig, F.M.D., M.A.P.P.
Organization:	Northwestern University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 020316
Project Period:	September 2011 - September 2013
AHRQ Funding Amount:	\$299,999

Summary: Transitioning to home from a neonatal intensive care unit (NICU) with a very low birth weight (VLBW) infant can be stressful for parents. VLBW infants who are discharged, or “graduate,” from the NICU have complicated home and outpatient care needs well into the first year of life and beyond. Many are discharged from the hospital with special health care needs, including home oxygen and monitoring, gastrostomy tube feeds, and complex medication regimens. These infants have a high rate of morbidity and frequent re-hospitalizations. Little research has been done on the factors that support parents in the successful transition of their VLBW infant from the NICU to the home, although research indicates that parents feel anxious and unprepared for discharge.

In an effort to support parents of VLBW NICU graduates, this project is developing a health information technology (IT) intervention known as the NICU-2-Home Service. This patient-and caregiver-centered service uses IT, including smart phones and tablets, to provide an informational and communication lifeline to parents as they move from the NICU to their homes and eventually establish a medical home with their pediatrician. The service is intended to empower parents, increase their self-efficacy and competency, and reduce their stress in caring for their NICU graduates. Mobile communication technologies and digital media content will provide parents with supportive guidance on the discharge process and post-discharge care; easy access to information and enhanced communication; tools, such as a care calendar and a care diary, to streamline the transition from the NICU to home; and links between the NICU, home, and the community pediatrician after discharge.

The NICU-2-Home system is being developed in collaboration with researchers at Northwestern University’s Feinberg School of Medicine and the technology company Motorola Mobility, Inc. Appropriate clinical, educational, and medical history information such as patient clinical information, immunization history, and growth data will form the foundation of the system. Smart phones with NICU-2-Home mobile applications, a bedside tablet, and a NICU-2-Home server will allow immediate delivery of necessary information to the appropriate person. An iterative development process is being used to build and refine the system. Focus groups have been conducted to collect qualitative data from primary users of the service—parents, neonatologists, and pediatricians. The data will help inform the development of the content, format, and interface of the system. A prototype will be developed and subsequent focus groups will provide additional feedback and assessment. Once final content and design decisions are made, the NICU-2-Home system will be pilot tested and its impact on outcomes such as parental self-efficacy, involvement, and stress levels will be evaluated. The final component of this

project involves a feasibility test in which parents of 100 VLBW NICU graduates will be randomized to a 1-month intervention of the NICU-2-Home Service or a control group.

Specific Aims:

- Design a novel health IT intervention, NICU-2-Home, using qualitative methods that will support both mothers and fathers of VLBW NICU graduates as they transition to home. **(Ongoing)**
- Implement NICU-2-Home in the NICU and during the transition to home. **(Upcoming)**
- Conduct a feasibility study with randomization in the NICU to test the ability of NICU-2-Home to: improve mothers' and fathers' self-efficacy and confidence in caring for their VLBW infants; decrease mothers' and fathers' stress as measured by self-report and salivary cortisol sampling; and enhance mothers' and fathers' involvement as measured using standardized tools with their VLBW infants as compared to controls. **(Upcoming)**

2011 Activities: Activities related to the development of the NICU-2-Home Service are well underway. Focus groups have been conducted with three groups of stakeholders: 1) mothers and fathers of VLBW infants in the NICU; 2) neonatologists; and 3) pediatricians. The data collected from the focus groups are currently being transcribed, coded, and analyzed.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and the project budget funds are somewhat underspent. As staff were in process of being hired, personnel costs were less than projected for the first quarter of the project.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Children with Special Health Care Needs (CSHCN), Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

An Evaluation of an Interactive Social Media Web site for Parents who are Concerned about Immunizing their Children

Principal Investigator:	Glanz, Jason, M.S., Ph.D.
Organization:	Kaiser Foundation Research Institute
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019760
Project Period:	September 2010 – September 2012
AHRQ Funding Amount:	\$165,301

Summary: Immunizations are one of the most significant public health achievements of the 20th century, preventing more than 2 million deaths per year worldwide. However, as the incidence of vaccine-preventable diseases has declined, public concern has shifted from disease transmission to vaccine safety. An increasing number of parents in developed countries now believe the risks of vaccines outweigh their benefits. Research has shown that parents who decline or delay immunizations greatly increase their children's risk of pertussis (whooping cough), varicella (chicken pox), and measles infections. Research also shows that the health information that vaccine-hesitant parents obtain from the Internet is often inaccurate and biased.

Effective intervention strategies are needed to reduce parental concerns about immunizations. The objective of this study is to develop and evaluate an interactive social media Web site for parents who have concerns about vaccines. The Web site features an interactive vaccine scheduler as well as various social media applications including a blog, a discussion forum, and a chat room. It is also a resource for providers who are interested in obtaining information about the latest vaccine-related concerns and discussing vaccine-related topics with other providers.

The Web site will be piloted among patients and physicians of Kaiser Permanente Colorado (KPCO), a closed-panel, group-model health maintenance organization that provides integrated health care services to the Denver-Boulder Metropolitan Area. The Web site will be moderated by physicians and vaccine researchers at the KPCO Institute for Health Research. Use of the Web site will be qualitatively and quantitatively assessed over time and will include a longitudinal assessment of the pilot cohort's knowledge, attitudes, and beliefs about immunizations. This pilot investigation will inform future research to implement a larger, integrated behavioral health intervention to reduce parental concerns about vaccinations and increase immunization rates.

Specific Aims:

- Design and develop an interactive, social media Web site devoted to immunizations. **(Ongoing)**
- Conduct a qualitative, formative evaluation of the social media Web site using focus groups. **(Achieved)**
- Qualitatively and quantitatively evaluate Web site usability through one-on-one testing sessions with end users. **(Ongoing)**
- Pilot test the social media Web site with a representative cohort of end users over a 6-month followup period. **(Upcoming)**

2011 Activities: The interactive social media Web site was developed. Vandiver Group, Inc., built the Web site platform, and Dr. Glanz and his team wrote the Web site content. Significant consideration was given to deciding on the tone of the Web site. Dr. Glanz took a pro-information approach that includes validating concerns about vaccination and providing high-quality educational information. While the Web site is inherently pro-vaccine, Dr. Glanz did not want it to be so overt that undecided parents would be turned off.

Focus groups were conducted among parents who refused, delayed, or accepted vaccines for their children. Feedback from the focus groups was analyzed and the Web site is being modified to reflect the input from the focus group participants. One such modification was the addition of a table of all vaccines used by KPCO and the ingredients in those vaccines. The research team has received several requests from KPCO pediatricians to use the ingredient table in their practices, so the practices can share copies of the table with their patients. The research team also created a video that is prominently featured on the Web site. The video features two KPCO pediatricians who are married and have children and discuss childhood vaccination.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is roughly on target. They are slightly behind due to initial delays with Web site development, but do not expect this to affect their overall project deadlines.

Preliminary Impact and Findings: The feedback from the focus groups was very positive. All participants liked the Web site, regardless of whether they refused, delayed, or accepted vaccines for their children. Participants reported that the tone of the Web site was inclusive, informative, and unbiased. Several participants remarked that they were happy to see that the money did not come from a private organization, or an organization known for pushing a particular vaccine agenda. Participants appreciated the information explaining the diseases, and some even requested additional information. The interactive vaccine scheduler and the video were also popular features of the Web site. Criticisms included that participants felt that the interactive tool that explains aluminum levels present in vaccines was not clear, and they wanted to see more photographs of fathers on the Web site. Parents wanted additional information about vaccines as well as clearly cited references.

Target Population: Other Conditions: Pertussis, Varicella, Measles, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Enhancing Fulfillment Data in Community Practices for Clinical Care and Research

Principal Investigator:	Kahn, Michael G., Ph.D., M.D.
Organization:	University of Colorado Denver
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019726
Project Period:	September 2011 - March 2013
AHRQ Funding Amount:	\$190,455

Summary: In ambulatory care, there are two major forms of prescription data. *Prescribing data* represent what clinicians have prescribed for patients—ideally, the *intended* medication regimen. *Fulfillment data* represent what patients have received from the pharmacy—the *actual* medication regimen. While community practices that use electronic prescribing (ePrescribing) are obtaining new access to fulfillment data, many questions still remain about the actual accessibility, comprehensiveness, and utility of these fulfillment data for clinical care and research. Better informed medication management has the potential to improve the quality, safety, and efficiency of the health care system, particularly when there is bidirectional information that includes both prescribing and fulfillment data. In a fragmented medical system, providing clinicians with fulfillment data has the potential to improve coordination of care by revealing what other clinicians have prescribed for a patient. It may also help clinicians provide better-informed care by revealing whether a patient has been able to adhere to prescribed drug regimens.

This project is using the Distributed Ambulatory Research in Therapeutics Network (DARTNet) to assess and improve the accessibility and utility of fulfillment data in community practices. The focus of this study strives to extend beyond what occurs at the pharmacy level to include additional information on prescriptions submitted by other providers. DARTNet, funded by the Agency for Healthcare Research and Quality, is an electronic practice-based network that is uniquely qualified for this assessment because it includes 32 independent and geographically-dispersed organizations encompassing more than 1,700 clinicians and 4 million patients. For this project, member practices will be surveyed for their use of ePrescribing and the accessibility and utility of fulfillment data in their electronic health records. Fulfillment data will be extracted from five of those practices and assessed for completeness and accuracy. The utility of using prescribing and fulfillment data to identify unintended continuation of medication and duplication of therapy will be explored.

Specific Aims:

- Use surveys and interviews to assess the actual status, organizational plans, and barriers for full ePrescribing, capture of fulfillment data, and clinician use of fulfillment data at all DARTNet organizations. **(Ongoing)**
- Assess the data's comprehensiveness and clinical utility in five DARTNet organizations receiving fulfillment data through the ePrescribing-based process, the consent-based process, or both. **(Ongoing)**
- Develop and pilot test a patient-level report used using clinical, prescribing, and fulfillment data to improve the management of hypertension during the clinical encounter, with subjective assessments

of utility by survey and group interviews of clinicians in one DARTNet organization capturing fulfillment data. **(Upcoming)**

2011 Activities: During the first few months of the project, the focus of activity was on submitting the research application to the Colorado Multiple Institutional Review Board (COMIRB), developing the initial survey among DARTNet organizations, and creating the initial list of proposed data elements for extraction of fulfillment data.

The first submission to COMIRB was made in October 2011, from which minor modifications were requested. The application was re-submitted December 2011 and COMIRB approval was granted on December 21, 2011.

The survey was created using Research Electronic Data Capture (RedCap), a public domain survey tool used in more than 100 institutions. The survey that was developed was based on previous informal email survey questions used in years prior but differs in its ability to include conditional questions using RedCap's logic. Four internal reviewers were used as pilot testers for the survey, resulting in significant modifications during its development, and the addition of conditional logic to improve the flow of questions and topics. More complicated than originally anticipated by the study team, the final version of the survey includes three levels of conditional logic.

In developing the list of proposed data elements, the project team had to consider data availability dependent on the data feeds available at the selected sites. Following a review of the survey data, the team will work with the proposed sites to evaluate data availability for extraction.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track, and project budget spending is on target.

Preliminary Impact and Findings: There are no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Evaluation and Integration of an Automatic Fall Prediction System

Principal Investigator:	Kearns, William D., M.A., Ph.D.
Organization:	University of South Florida
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (R21)
Grant Number:	R21 HS 018205
Project Period:	December 2009 – September 2012
AHRQ Funding Amount:	\$299,452

Summary: Falls among the elderly are a significant cause of morbidity, mortality, and increased end-of-life health care costs. Reducing the occurrence of falls can greatly improve patients' quality of life. This study is developing and evaluating a method to track variability in everyday movements as an additional means to predict risk of falls for elderly residents in assisted living facilities (ALF). It aims to demonstrate that increased movement variability is a stronger predictor of fall risk than two other well-known risk factors—history of falls and use of prescribed psychoactive medications—and that collectively, prediction of fall risk is significantly improved. Dr. Kearns and his research team anticipate that the new method will be a useful tool for relating changes in fall risk to alterations in health and medications. The tool has been patented and commercial venture initiated to distribute the technology internationally.

This project recruited 53 volunteer residents from two ALF facilities. Baseline standardized gait and balance (SGB) assessments were completed. The velocity, distance and duration, and changes in direction during movements of the volunteers' daytime movements in common areas of congregate living settings were tracked over 12 months by a movement tracking system (MTS) via ultra-wideband active tag radio frequency identification devices. Prospective and retrospective fall histories were evaluated to determine the relationship of SGB and a measure of movement variability called Fractal D path tortuosity (Fractal D) derived from MTS data using software created for this project. Fractal D is a measure of deviation from a straight line of travel.

During the study, a complete evaluation of participant medications was conducted, with particular emphasis on identifying and recording the number of psychoactive and non-psychoactive medications that each participant was prescribed. Each participant's activities of daily living (ADL) status was measured at the time of enrollment, along with 12-month retrospective fall incident data. Information about the causes of falls was obtained from ALF staff using a standardized fall incident assessment also used to collect the 12-month prospective fall data. Medications, ADLs, and residents' history of falls and Fractal D were entered as predictors in a multinomial logistic regression analysis, with falls as the outcome measure. The study team hypothesized that SGB would vary significantly with the MTS Fractal D measures, allowing Fractal D to be used as a proxy for SGB assessments while yielding improved fall prediction.

Specific Aims:

- Evaluate the relationship between conventional fall-risk assessment measures using performance on SGB tests and Fractal D movement tortuosity measures obtained through the MTS. **(Achieved)**

- Evaluate tortuosity changes preceding a fall. **(Achieved)**
- Gather requirements for a software module to perform online fall-risk assessment in community-based settings. **(Achieved)**

2011 Activities: All medication data and fall history information for the baseline period and the monitoring interval was entered into the project database. Additionally, the research team continued medication coding and analysis. An abstract describing the results of the multinomial logistic regressions comparing traditional fall risk factors (prior fall and presence of psychoactive medications), against MTS Fractal D measures was submitted for presentation at the International Society for Gerontechnology's 2012 annual meeting to be held in Boston, November 14-18.

Results from the 53 subjects indicate that Fractal D is linked to future fall activity in ALF residents and that its contribution is quantifiable. Analyses of SGB measures and future fall risk showed that stride time coefficient of variation (COV) was a significant predictor of future falls for 35 of 53 subjects who could generate data. Fractal D was correlated with number of steps and time required to complete the *180 Degree Turn Test* and negatively correlated with the number of degrees rotated and sway area. Fractal D correlated positively with the time required to complete the *Get up and Go Test* and positively with *Walking Test* Dual Task stride-to-stride velocity COV.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and the project budget spending is on target.

Preliminary Impact and Findings: The logistic regression analysis performed on the 53 subjects revealed that the odds of falling increased by 4.06 times for every 0.1 increment in Fractal D levels the week before the event, and increased 3.45 times if a fall had occurred in the year prior to the study. The number of psychoactive medications approached but did not reach significance as a contributor to falls; neither was the mean path length a significant predictor of future falls, although there was a strong trend for longer paths and an absence of psychoactive medications to be associated with reduced fall risk. The concordance rate for the overall model was 82 percent.

SGB measures were available for too few subjects, (37 of 53) to conduct a multinomial logistic regression including the other measures listed above, largely due to the frailty of the subjects; many simply could not perform the stride test or other tests. Stride time COV was compared with the 7-day Fractal D mean, presence of more than one psychoactive medication, and the mean distance traveled in the 7 days before the event as predictors in a multinomial logistic regression. The results of the logistic regression on the reduced set of 34 subjects demonstrated that the COV was the best predictor of future falls. Fall probability increased 1.48 times for every .01 increase in the COV. No other variable was significantly related to fall risk, although Fractal D approached and may have reached statistical significance had more subjects been able to perform the stride time test. The concordance for the final model with 34 subjects was 87 percent. The logistic regression analysis was repeated on the same subjects dropping COV, and Fractal D was found to be the only significant predictor. A 0.1 increase in Fractal D was associated with a 4.17 times increase in fall likelihood. Neither the presence of more than one psychiatric medication nor the mean travel distance in the 7 days before the event was a significant predictor; the concordance rate for the model was 75.8 percent.

The study results indicate that a telesurveillance technology capable of extracting spatial variability information from free-moving elderly in assisted living facilities can provide useful information predictive of future falls in individuals who may be too frail to engage in standardized gait and balance testing.

Target Population: Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Promoting Use of an Integrated Personal Health Record for Prevention

Principal Investigator:	Krist, Alexander H., M.D.
Organization:	Virginia Commonwealth University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 018811
Project Period:	June 2010 – June 2012
AHRQ Funding Amount:	\$299,998

Summary: Personal health records (PHRs) integrated with electronic medical records (EMRs) are potential tools to promote patient-centered care and ultimately improve health outcomes. Although adoption and use of integrated PHR-EMRs is increasing, effective use of such systems typically occurs only within a subset of a primary care practice's patient population.

In a previous Agency for Healthcare Research and Quality-funded project, [MyPreventiveCare](#), an integrated PHR-EMR otherwise known as the Integrated Personal Health Record (IPHR), was offered to 2,750 patients in eight primary care practices—about 3 percent of the total practice population. Use of the system increased the overall delivery of preventive services by more than 5 percent, and by more than 10 percent for some specific individual services such as colon, cervical, and breast cancer screenings. MyPreventiveCare linked patients to their health information in their physician's EMR; provided personally-tailored prevention recommendations to patients; linked patients to individualized educational resources and decision aids to activate patients and promote self-management; and generated patient and clinician reminders.

This followup project is evaluating whether and how these eight primary care practices can extend the use of MyPreventiveCare to their entire practice population (82,000 patients), and whether similar outcomes and benefits are seen when the system is implemented on a larger scale.

Dr. Krist and his research team are applying organizational change theory to develop guidance on how to integrate MyPreventiveCare into care delivery using practice champions, learning collaboratives, and a patient-centered communications strategy. Study staff is conducting key informant interviews and recording and analyzing learning collaboratives to understand the mediators and moderators to integration and use of the system. Evaluation of the impact of practice dissemination of MyPreventiveCare is based on the RE-AIM model, a systematic approach to evaluating health promotion interventions that assesses five dimensions: reach, efficacy/effect, adoption, implementation, and maintenance.

Specific Aims:

- Measure the utilization of the IPHR when the IPHR is promoted to patients by primary care practices using a patient-centered approach integrated into care delivery. **(Ongoing)**
- Assess how clinicians use information in the IPHR and the IPHR's impact on the delivery rates of preventive services. **(Ongoing)**

- Explore how well practices integrate the IPHR into care, identify mediators and moderators (patient, provider, and practice characteristics) to IPHR integration, assess the use of the IPHR, and the degree to which it impacts service delivery. **(Ongoing)**

2011 Activities: Four post-implementation learning collaboratives were held during this period. A patient survey was completed and fielded, and a physician survey development is in the final stages. Five sites began implementation. MyPreventiveCare was programmed to show patients all their labs with a linked doctor's message; this is significantly expanding MyPreventiveCare's functionality and increasing its value for practices. It will also provide a unique opportunity to observe the impact of this new functionality on increasing the proportion of practice patients who register to use the system.

The project team is working with Intuit Health to explore integrating MyPreventiveCare as their primary portal for the practices' patients. The practices are currently fielding two patient portals—MyPreventiveCare and Intuit's proprietary portal—to their patients. Each portal has a different functionality, which causes either confusion or under-use of MyPreventiveCare. Combining these portals would streamline the practices' workflow and reduce patient confusion about the functionality of the separate systems. However, Intuit Health's competition for programming resources is slowing down the potential for integration.

As part of the implementation strategy, the project team provides each practice with a weekly report on the number of new MyPreventiveCare registrants. This is a surrogate for reach and maintenance. Collectively, the study sites are getting approximately 200-250 new registrants per week, representing 10-to-20 percent of all unique patients who present for care in a week. Additionally, learning collaborative members asked that the project create a new user recruitment target for each office to further encourage offices to get patients to use the system.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is roughly on target.

Preliminary Impact and Findings: Practices successfully incorporated the IPHR into workflow and used it to prepare patients for visits, augment health behavior counseling, explain test results, automatically issue patient reminders for overdue services, prompt clinicians about needed services, and formulate personalized prevention plans.

The preliminary use of the IPHR offers encouragement that the IPHR and similar patient-centered information systems might be generalizable and scalable to a wide range of primary care practices. Further research is needed to replicate these findings elsewhere. Additionally, outcomes data are needed to determine the impact of the IPHR on the delivery of care and on patient engagement in decisionmaking. Future manuscripts that detail the findings of the efficacy, adoption, and dissemination trials will contribute to this evidence. The ultimate goal of transforming information systems is to improve the delivery of care and the health of patients. PHRs can play a pivotal role in helping to engage, inform, and motivate patients. While significant advances have been made in the design, adoption, and implementation of PHRs, much more is needed.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Symptom Monitoring and Reporting System for Pediatric Chronic Illness

Principal Investigator:	Lai, Jin-Shei, Ph.D., OTR/L.
Organization:	Northwestern University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019071
Project Period:	March 2011 - February 2013
AHRQ Funding Amount:	\$297,787

Summary: Children experience distressing physical symptoms caused by cancer and its treatment, with fatigue being the most prevalent symptom. Efforts to manage cancer-related symptoms in children have not kept pace with advances in cancer treatments. Factors contributing to poor symptom management include delay in reporting symptoms to clinicians, limited time during clinic visits, and logistical and organizational barriers that limit the quality of symptom care.

Using health information technology (IT) to alert patients' parents and providers of significant changes in symptoms is one recommended strategy for improving symptom management. This project intends to do that by extending an existing symptom monitoring and reporting system for adult oncology patients to the pediatric oncology population. Dr. Lai and her team will do so by developing a system known as Symptom Monitoring & Systematic Assessment in Young Survivors, or SyMon-SAYS (formerly SyMon-Peds). SyMon-SAYS is a patient-oriented system intended to provide a mechanism for reporting symptoms experienced by pediatric cancer patients to their parents and health care providers. This study focuses on monitoring only a single symptom; fatigue. By using the SyMon-SAYS system, pediatric oncology patients or their parents can report their fatigue at home between clinic visits using any Internet-accessible device, such as a computer or smartphone, or a regular telephone via interactive voice response (IVR) technology. Using templates developed for fatigue reports and programming SyMon-SAYS, the system will collect and store fatigue symptoms reported by patients and parents and will generate fatigue reports accordingly.

These reports will be transmitted to clinicians, detailing graphic displays of patients' weekly fatigue status and highlighting changes from week to week. Significantly high fatigue scores or increases in fatigue levels will be detected by the SyMon-SAYS system and activate an alert. This alert notifies a clinician to contact the parent of the patient to consult on managing fatigue or to ask the patient to come into the clinic. After developing and pilot-testing the system, a prospective cohort study of 100 patient (ages 7 to 17) and parent dyads will be conducted to evaluate: 1) the feasibility of implementing the SyMon-SAYS system in clinics; 2) patient/parent perceived usefulness; 3) provider satisfaction; and 4) efficacy of the SyMon-SAYS system in managing fatigue in pediatric cancer patients. Participants will complete an 8-week intervention in which they will login to the system weekly, either by telephone or Internet, to report on the perceptions of the patients' fatigue. If patients' fatigue scores reach or exceed a predefined threshold, a study nurse will notify oncologists and contact the patients' parents to provide care recommendations in real time. The overall goal of the project is for SyMon-SAYS to improve symptom management for pediatric cancer patients.

Specific Aims:

- Evaluate the feasibility of implementing the SyMon-Peds system in a pediatric oncology clinic, its acceptability (defined as perceived usefulness) by parents of children with cancer and the clinicians' and parents' satisfaction with the system. **(Ongoing)**
- Explore the efficacy of the SyMon-Peds in managing fatigue. **(Upcoming)**

2011 Activities: During 2011, the fatigue report templates were created and the SyMon-SAYS system was developed and programmed. The patient and clinician interfaces of the system (i.e., the Web site and the IVR system) were built and quality-assurance tested. Training materials for study personnel (physicians, nurses, and research assistants) at Children's Memorial Hospital were developed, and trainings were conducted in October 2011. The system was modified to incorporate suggestions made by clinicians during the training sessions.

Pilot testing of the SyMon-SAYS system was completed as planned. Five patient-parent dyads were recruited to test the functionality of the system, the data collection and management processes, and the feasibility of the logistics associated with the intervention flow. All five dyads completed the pilot testing. Based on the findings, the research team determined that no changes to the system or process were needed. The five dyads enrolled in the pilot test will continue participation and be counted as participants of the main study. Full implementation of the SyMon-SAYS system and recruitment will continue in 2012.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget funds are somewhat underspent because proposed funds for travel and personnel costs were less than anticipated for 2011. Specifically, the research assistant for this project was unable to dedicate the percentage effort needed to support the full set of tasks and responsibilities required by the project. In 2012, the research assistant's percentage effort for this project will be increased to better support the needs of this project, thereby spending down remaining funds from 2011.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Cancer, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Exploring Clinically-relevant Image Retrieval for Diabetic Retinopathy Diagnosis

Principal Investigator:	Li, Baoxin, Ph.D., M.S.
Organization:	Arizona State University-Tempe Campus
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019792
Project Period:	August 2011 - July 2013
AHRQ Funding Amount:	\$299,999

Summary: Diabetic retinopathy (DR) is the leading cause of new blindness in adults aged 20-74. Among diabetics, the prevalence of DR is 28.5 percent. Despite advances in diabetes care, visual impairment is still a devastating complication. Studies show that timely DR diagnosis and treatment can significantly reduce the risk of severe vision loss. Although digital retinal imaging has quickly become an alternative to traditional face-to-face evaluation, it is laborious and prone to error or reviewer fatigue. For this reason, researchers are exploring automated detection and evaluation of diabetic retinal lesions. Potential benefits of automated DR diagnosis include improved consistency and speed over human reviewers. However, clinicians remain superior in detecting and assessing the severity of DR over computer-based systems, which fail to incorporate the experience and variables that clinicians apply to their assessments. Therefore, more effort is required to improve the performance of such systems.

This research project explores an innovative method to retrieve clinically-relevant images for facilitating timely and accurate evaluation of DR. Images are considered clinically relevant if they contain the same types of lesions with similar severity levels. Dr. Baoxin Li and his team have extensive experience in acquisition and deployment of computer-assisted evaluation of DR. Building on their experience, the team will design machine learning-based algorithms for retrieving images of clinical relevance to contribute to building automated DR detection and evaluation systems. Additionally, the team plans to develop a prototypical DR image management system to improve reviewers' diagnostic performance. A direct outcome of the proposed research is a system that can provide a reviewer with instant reference to annotated images from a database. Maximizing the efficiency and accuracy of assessing DR could help prevent vision disabilities and their resulting high cost to the health care system.

Specific Aims:

- Develop a content-based retrieval system for referencing diabetic retinal images to improve diagnosis. (**Ongoing**)
- Develop a prototypical DR image management system to improve reviewers' diagnostic performance. (**Upcoming**)

2011 Activities: The initial focus of the project was to collect a sufficient number of DR images to support the development of the machine learning algorithm, which requires large amounts of data to diagnose different stages of DR. These stages include non-proliferative retinopathy (mild, moderate, and severe)

characterized by microaneurysms, and proliferative retinopathy, characterized by neovascularization. Initially, Dr. Li planned to use images from a researcher with a large database of images at the University of Wisconsin, but the researcher retired. As a result, Dr. Li contacted alternative potential collaborators around the country. To date, he has amassed approximately 500 images. While this is a large number of images, more will eventually be required to validate the algorithm.

Dr. Li began work on the algorithm using the available images. Currently there are five well-known algorithms to process DR Images. These existing algorithms do not sufficiently distinguish between shades of red, the dominant color in DR images. Dr. Li's team plans to focus on color contrast when developing their algorithm to address this weakness. To do this, the existing algorithms are being applied to each of the images in Dr. Li's collection. The algorithms work by extracting several hundred data points from each image and analyzing them. These results will serve as the benchmark for the newly-developed algorithm.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is on target.

Preliminary Impact and Findings: There are no findings to date.

Target Population: Other Conditions: Diabetic retinopathy

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge and Creation

VisualDecisionLinc: Real-Time Decision Support for Behavioral Health

Principal Investigator:	Mane, Ketan, Ph.D., M.S.
Organization:	University of North Carolina Chapel Hill
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 019023
Project Period:	August 2011 - July 2013
AHRQ Funding Amount:	\$299,997

Summary: In 2000, the societal burden of psychiatric disorders was estimated at \$83 billion, with \$26 billion attributable to direct medical expenses. A [research review](#) of psychiatric disorders, supported by the Agency for Healthcare Research and Quality, recommended that studies build the evidence-base on the most appropriate initial treatment strategies for maintaining a favorable response. Improving the initial selection of treatments has the potential to reduce the time to remission, as well as reduce the likelihood of medication errors and the adverse events caused by medication switching. There is consensus among clinicians and health policy experts that mental health decision support tools that aid clinical decision-making hold enormous potential to improve psychiatric care, including initial treatment strategies. One strategy is providing clinicians with expert and evidence-derived knowledge at the point of care. General guidelines often lack specific treatment algorithms that are tailored to a patient's unique symptom profile and disease history. Thus, supplementing clinical guidelines with data on treatment response from patients sharing similar profiles would narrow the range of treatment options to those based on the best available evidence.

To address these needs, Dr. Mane and his research team are developing a software-based decision support prototype known as VisualDecisionLinc (VDL). The VDL is designed to provide decision support for treatments of major depressive disorder (MMD), one of the most prevalent and burdensome psychiatric disorders. The project will: 1) develop new approaches to selecting comparative patient populations based on expert-, guideline-, and data-driven approaches; 2) develop software user interfaces to quickly allow clinicians to determine which treatment approaches have been effective for patients similar to the presenting patient; and 3) provide an initial evaluation of approaches in preparation of a larger scale deployment and test of clinical effectiveness. The research has the potential to help understand novel ways to leverage historical patient databases and to demonstrate a health information technology (IT) approach to optimize treatment choices for behavioral health care.

Specific Aims:

- Develop and validate expert-driven, guideline-driven, and data-driven attribute sets for the creation of comparative populations. **(Ongoing)**
- Develop a data visualization based user-interface to aid in the selection of treatment choices. **(Ongoing)**
- Conduct an exploratory effectiveness evaluation of VisualDecisionLinc in preparation for a larger scale, health IT implementation research. **(Upcoming)**

2011 Activities: The research team laid the ground work for this project by building a database to maintain and clean patient data from the electronic medical record (EMR) so that it may be imported into VLD. In collaboration with psychiatrists, the data were evaluated to identify a set of similarity attributes (SSAs) to define a comparative population. The SSAs include demographics such as race, gender, and age; comorbid conditions; and prescribed medications. The SSAs will form the basis of the analytical engine, which is a query that filters the database of patient information to identify a comparative population similar to the target patient. Subsequently, a VDL user-interface (UI) was developed and integrated with the analytical engine and the EMR such that providers may click to select SSAs of interest.

At the UI level, the prescribed medications were organized by medication class to facilitate the understanding of medication combinations prescribed to the comparative population. Additional data views were built to provide an at-a-glance view of comorbid conditions for the comparative population as well as an overview of the patient's medical profile, including medications, outcomes, and comorbidities. The UI also integrates a guideline view that shows patient data in relation to the Texas Medication Algorithm Project, which developed guidelines for the treatment of the MDD patients.

As last self-reported in the AHRQ Research Reporting Systems, project progress is mostly on track, and project spending is on target.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Mental Health/Depression

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision-making through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

The Virtual Patient for Improving Quality of Care in Primary Healthcare

Principal Investigator:	Mollica, Richard, M.D., M.A., M.A.R.
Organization:	Massachusetts General Hospital
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 020323
Project Period:	September 2011 – September 2013
AHRQ Funding Amount:	\$296,320

Summary: Traumatic experiences can have significant impact on one's mental and physical health. It is well established that trauma is associated with posttraumatic stress disorder (PTSD) and depression. Traumatic experiences are also associated with negative health behaviors—such as poor diet, smoking, sedentary lifestyle, and alcohol and substance abuse—that compromise physical health. Refugees are an example of a highly-traumatized patient population demonstrating high rates of PTSD, depression, and physical disability. Traumatized refugee patients seeking health care may face many barriers related to socioeconomic status, cultural medical worldviews, limited English proficiency, and low levels of health literacy. In order to effectively diagnose and treat highly traumatized refugees, primary care providers (PCPs) need to be trained in accurate diagnosis and treatment. Specifically, PCPs need to be 1) aware of the trauma-related mental and physical health problems that refugee populations often experience; 2) knowledgeable of the barriers to health care refugee populations may face and how to overcome them; and 3) able to identify and treat trauma as a medical and mental health risk factor in a culturally-sensitive way.

Dr. Richard Mollica and his research team at the Harvard Program in Refugee Trauma at Massachusetts General Hospital are collaborating with researchers at the Karolinska Institutet's Virtual Patient Lab, in Stockholm, Sweden, to develop a virtual patient (VP) that will help train PCPs to accurately diagnose and treat trauma-related medical and mental health problems among highly-traumatized refugee populations. A VP is an interactive computer simulation that provides a virtual representation of a patient encounter for learning and assessment. The VP has been well established as an efficient and cost-effective training tool in health care. This project will implement a VP in primary care to help providers build their clinical capacity for the cultural and evidence-based identification and treatment of traumatized refugee patients from disadvantaged, diverse backgrounds.

This project is being conducted in two phases. Phase I involves the development of the VP β -prototype from the existing VP α -prototype. Ten PCPs from the Lynn Community Health Center (LCHC) in Boston, Massachusetts, were recruited to participate in the development process. These PCPs will participate in a three-part series in which the VP is first described and the VP α -prototype is then presented to the PCPs. Semi-structured interviews and surveys will be administered as a pre-test and post-test to collect information on the PCPs' preconceptions, attitudes, thoughts on usefulness, and recommendations for informing the development of the VP β -prototype.

Phase II of the project will test the effectiveness of the VP β -prototype to improve the abilities of PCPs at LCHC to identify, screen, and treat the physical and mental health problems of the traumatized refugee patient presented by the VP β -prototype. The VP β -prototype will be administered to 30 PCPs, including the 10 PCPs who participated in Phase I of the project and 20 additional randomly-selected PCPs at LCHC. The 30 PCPs will participate in three onsite sessions at which they will be administered clinical cases for patient assessment and the development of a treatment plan, followed by an introduction and review of the VP β -prototype.

A survey will be used to rate the quality of the PCPs' treatment plans pre- and post-viewing of the VP β -prototype. Additionally, the semi-structured interviews and surveys used in Phase I of the study will be administered to the Phase II PCPs pre- and post-viewing of the VP to qualitatively assess the PCPs' perception of the VP β -prototype as a training and clinical tool. A followup phone call will collect qualitative data from the PCPs on the strengths and weaknesses of the VP and their recommended improvements to the VP β -prototype.

Successful development and implementation of the VP is intended to improve PCPs' assessment and treatment of trauma-related physical and mental health problems in highly-traumatized, culturally-diverse refugee patients. The VP will ultimately improve the quality of care for disadvantaged and culturally-diverse refugee patient populations who experience trauma-related physical and mental health issues.

Specific Aims:

- Develop a final Virtual Patient β -prototype (from the existing α -prototype) that is perceived as an effective and engaging learning tool by primary care physicians. **(Ongoing)**
- Test the ability of the Virtual Patient β -prototype to improve the primary care physicians' identification and screening of health and mental health problems in traumatized and culturally-diverse patients. **(Ongoing)**
- Test the ability of the Virtual Patient β -prototype to improve the primary care physicians' treatment management plan of the health and mental health problems of traumatized diverse patients. **(Ongoing)**
- Assess the feasibility of expanding the use of the Virtual Patient among primary care physicians at neighborhood health centers. **(Ongoing)**

2011 Activities: The study team at Massachusetts General Hospital and their collaborators at the Karolinska Institutet have met every other week by phone. The VP α -prototype was assessed and modified for Phase I testing. Ten PCPs from LCHC were recruited to participate in the Phase I pre- and post-testing of the VP and the existing VP α -prototype.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track, and project budget spending is roughly on target.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Mental Health/Depression, Racial or Ethnic Minorities*: Bosnian Refugees

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Synthesis and Dissemination

** This target population is one of AHRQ's priority populations.*

HIE and Ambulatory Test Utilization

Principal Investigator:	Nease, Donald, M.D.
Organization:	University of Colorado Denver
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 018749
Project Period:	May 2010 - April 2012
AHRQ Funding Amount:	\$299,916

Summary: One of the purported benefits of health information exchange (HIE) is that it can improve the efficiency of care by reducing redundant laboratory and radiology testing. There is evidence that test utilization is reduced substantially within institutions, such as medical centers that implement comprehensive electronic medical records. If physicians can easily access the results of tests that have already been performed, they are less likely to repeat them. However, while it is intuitive that HIE across organizations in a community would improve the coordination of care, there is scant evidence that community HIE results in a reduction in test utilization. As the United States explores investments in HIE to improve the quality of care, policymakers and potential stakeholders in HIE, such as health plans, need more estimates of the degree to which HIE improves the efficiency of care.

Mesa County, Colorado, is a rich resource for more definitive assessments of the effects of HIE. Quality Health Network (QHN), a regional HIE that started providing data exchange to Mesa County in 2005, captures nearly all the test results in the county and has been adopted by more than 351 practitioners, which is more than 85 percent of practitioners in the county. There is also evidence that since HIE was introduced reductions in laboratory and radiology utilization in Mesa County contrast with national trends of steady or increasing test utilization. This study will formally assess whether adoption of a community-wide HIE reduces utilization of laboratory and radiology testing. The primary study design is a retrospective pre-post comparison of providers working in Mesa County medical practices. Analyses are being conducted at the practice and the provider level. These analyses employ general linear mixed models, with rates and costs of tests as the outcome variables and adoption over time from 2005 to 2010 as the primary predictor variable.

The electronic exchange of health information in communities may improve the quality and efficiency of medical care. Doctors can make better decisions when the health information they need is on hand. By assessing whether a robust, mature regional HIE system helped doctors provide more efficient medical care, this project will provide estimates of value that will prove useful for national decisionmakers and local stakeholders in HIE, and will help guide future HIE efforts.

Specific Aim:

- Determine whether adoption of HIE in Mesa County, Colorado, is associated with a reduction in test ordering. **(Ongoing)**

2011 Activities: The study team conducted a crosswalk of the numeric practice ID and practice name from QHN, which allowed the team to complete the necessary data cleaning and quality checks. The

crosswalk was necessary because the study team found that practices that had not adopted HIE by December 2010 were not reliably identified in the dataset. However, they were able to recover several “never-adopters” by reviewing these data.

In writing and running the SAS code for the descriptive analysis of data, the team also discovered an issue related to the interpretation of the “ordering provider.” Therefore, a new algorithm for attributing an ordering provider to laboratory and radiology claims was implemented to better support the analysis and modeling phase of the project. Since then, a simple descriptive analysis of the data has been completed, as has the initial work on developing the analytic model.

Next steps will include finalizing the data analysis of the effects of health information exchange on rates of test ordering. The investigators, in conjunction with the CEO of QHN, will present initial findings at the national Healthcare Information and Management Systems Society meeting in February 2012. Manuscript development will also take place in the final year of the project.

As last self-reported in AHRQ’s Research Reporting System, project progress and activities are on track and the project budget is underspent. The budget underspending was due to the delay caused by the purchase of ManagedCare by TransUnion in late 2010. Because ManagedCare was the agency providing the project with claims data for the analysis, new business associate agreements had to be developed. Once the new agreements were signed, data became available and the team was able to resume working at full effort.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Healthy Teens TXT ME: Information Technology to Change Teen Health Risk Behaviors

Principal Investigator:	Olson, Ardis L., M.D.
Organization:	Dartmouth College
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21)
Grant Number:	R21 HS 018214
Project Period:	November 2009 – March 2012
AHRQ Funding Amount:	\$299,978

Summary: Adolescence is a time of rapid and complex change during which health risks stem more from behavioral factors than biomedical factors. While many behaviors are experimental, habits and coping patterns developed during this developmental stage may continue into adulthood. Research has shown that school-based interventions for major risks are often nominally effective or ineffective. Interventions that use motivational interviewing and technology to enhance screening and counseling of adolescents are costly, intensive, and require additional time, staff, or computer resources not generally available to most primary care providers. This project seeks to utilize information technology (IT) to develop an integrated screening, counseling, and post-visit support system to increase physical activity among adolescents.

Dr. Olson and her research team programmed and tested the Healthy Teens personal digital assistant (PDA) screening program software that supports effective clinician counseling about exercise uptake. In addition, the software was programmed to produce a summary report that will transfer data into patient electronic medical records for future reference. A system of IT-based post-health visit supports was created to help teens increase exercise. The first support was tailored cell phone text messaging to teenagers who indicated that they were interested in behavior change. A Healthy Teens TXT ME social network site was established for project participants to share experiences and support their change efforts. The text messages sent to teens informed them about developments and new links on the network site.

Two feasibility pilots of the TXT ME program were implemented with post-visit support in eight primary care practices over 3 months. Two cohorts per pilot were recruited from adolescents who indicated at their clinic visit that they wanted to increase their physical exercise. The first cohort was the control and its participation was limited to survey completion. The second cohort received post-visit supports for exercise via cell phone text messaging and had access to the social network site. Teen acceptability and short-term-change efforts were assessed.

Specific Aims:

- Enhance the TXT ME PDA-based health risk screening tool with clinician prompts to support effective counseling for exercise uptake and tobacco cessation from evidence-based literature and existing public health and patient counseling programs. **(Achieved)**
- Develop the format, message delivery algorithm, and technological processes to link PDA-based teen health screening data from the primary care visit to tailored followup health behavior change text messages delivered by cell phone. **(Achieved)**

- Develop the prototype of adolescent health behavior change support via a social network Web site that links adolescents in the project and provides access to Web-based resources. **(Achieved)**
- Conduct a small feasibility trial of the exercise component of the TXT ME model that will use PDA technology to screen adolescents who are interested in changing exercise patterns and prompt clinicians to provide reinforcement via post-visit text messaging to help teens make these changes. Evaluation will include short-term outcomes related to text message design and health behavior outcomes. **(Ongoing)**

2011 Activities: The study staff recruited patients for study participation. In Phase One of the study, participants were offered counseling about exercise during office visits. In Phase Two, intervention arm participants received 6 weeks of brief daily text messages to provide motivational and practical support. Enrollees participated in three phases of data collection. The following information was collected at baseline: physical exercise in last 24 hours and past 3 days; whether the doctor discussed exercise during the last clinic visit; exercise goals and changes for the next month; attitude about exercise; stress level; access to exercise equipment; barriers to exercise; time spent on computer and watching television; and health risks. At the end of the intervention period, follow-up data was collected on changes in attitude about exercise, level and amount of time spent exercising, stress, and access to exercise equipment. One month after the intervention, the same follow-up data was collected. Qualitative interviews were conducted with a subset of participants to assess usability and likeability.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track with the revised timeline, and the project budget is roughly on target. A 6-month no-cost extension was used to allow for a lengthier recruitment period so that the research team was able to meet their recruitment goals.

Preliminary Impact and Findings: A total of 3,811 adolescents in eight primary care practices were screened for health risks. Forty-eight percent (1,840) expressed interested in increasing their exercise level, and 35 percent (622) of those expressed interest in learning about the study. Four-hundred-and-eighty-nine patients met the eligibility criteria and 208 enrolled in the study. The study cohort was 69.5 percent female and the mean age was 15.5 years.

Qualitative interviews were conducted with 20 study participants. Overall, feedback was positive and indicated that the study was well received. The nutrition text messages were very popular among participants. Most study participants preferred pragmatic messages that provided useful tips or information, as opposed to the motivational messages. About half of the participants who used the social network Web site ranked it favorably. The other half of study participants did not use the Web site because it was viewed as another system to log into. Feedback was mixed regarding early morning text messages; however, there was agreement that the frequency of messages was appropriate.

Quantitative data analysis indicated that providers discussed exercise 44.7 percent of the time and that 97 percent of participants found the discussions somewhat or very helpful. Forty-eight percent of children started exercising when counseled by their doctor, while 30 percent initiated exercise without counseling. Physician counseling was positively associated with increasing exercise and beginning new types of exercise. The text messages combined with counseling from providers resulted in a two-fold intervention. In 2012, the research team will focus on the analysis of the next messaging intervention.

Target Population: Obesity, Teenagers, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Improving Adolescent Primary Care Through An Interactive Behavioral Health Module

Principal Investigator:	Ozer, Elizabeth, Ph.D., M.A.
Organization:	University of California, San Francisco
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 020997
Project Period:	September 2011 - August 2013
AHRQ Funding Amount:	\$155,821

Summary: Most adolescents visit a health care provider once a year, providing an opportunity to integrate behavioral/emotional health screening into clinical care. Yet despite clinical guidelines, providers screen adolescents for risky health behaviors and depression at rates consistently lower than recommended. Therefore, new strategies are needed to increase behavioral health screening in primary care. Health information technology (IT), such as an electronic health record with clinical decision support (CDS), has tremendous potential to improve health care quality and subsequent behavioral health outcomes for adolescents. Many adolescent health problems are amenable to behavioral intervention, and most teenagers are comfortable using interactive computerized technology, yet few health IT interventions have been integrated into adolescent care.

This exploratory project is developing a theoretically-based interactive behavioral/emotional health module for adolescents that can be integrated into health care delivery, serving as both a risk assessment and an intervention tool to enhance adolescent behavior change. After the module has been developed, it will be piloted in adolescent primary care practices, assessing clinician, adolescent, and system outcomes. The study is being conducted within the San Francisco Bay Collaborative Research Network (CRN) through the University of California, San Francisco (UCSF). From these ethnically- and economically-diverse clinics, a sample of adolescents ages 12 to 18 years will be recruited to participate. Multiple approaches and data sources will be utilized to conduct quantitative and qualitative analyses on each of the outcomes of interest.

The overarching goal of this project is to better understand how the proposed intervention addresses the diverse needs of teenagers, informs the contextual factors that contribute to quality of implementation in varied clinic contexts, and informs strategies for adaptation and integration in larger scale health IT implementation. Ultimately, this project will help inform the development and implementation of health information tools into the primary care setting while also focusing on technology that supports patient-centered care.

Specific Aims:

- Develop a theoretically-based interactive behavioral/emotional health module for adolescents that can be integrated into health care delivery, serving as both a risk assessment and an intervention tool to enhance adolescent behavior change. **(Ongoing)**

- Pilot-test the implementation of the computerized module/screening system in adolescent primary care, assessing clinician, adolescent, and system outcomes. **(Upcoming)**

2011 Activities: During the first quarter, the project staff focused on: 1) reviewing existing interactive modules to determine appropriateness of materials for application to development of this particular behavioral health module; 2) contacting medical directors and other key staff in clinics that have expressed support for involvement in development and integration of the intervention module in their clinic site; and 3) obtaining institutional review board approval for the research project from the Committee on Human Research at UCSF.

The study team continues to communicate regularly with UCSF colleagues to discuss adaptation and options for development of the adolescent health module, as well as the details of module development and building off their existing adolescent screening tool. In addition, the team is investigating how a screening tool might be integrated broadly within the new UCSF electronic medical record system.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track, and project budget spending is on target.

Preliminary Impact and Findings: There are no findings to date.

Target Population: Pediatric*, Teenagers

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Improving Health Care Quality Through Health Information Technology for People With Intellectual Disability

Principal Investigator:	Rimmer, James Howard, M.S., Ph.D.
Organization:	University of Illinois at Chicago
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (R21)
Grant Number:	R21 HS 018766
Project Period:	June 2010 - May 2012
AHRQ Funding Amount:	\$300,000

Summary: Caregivers and service providers who are responsible for the health of adults who have intellectual disabilities (ID) face numerous obstacles navigating a health care system that is not often organized to respond to and recognize the unique health needs of persons with ID. This may lead to higher rates of morbidity and poorer quality of life. Fragmentation of care is frequent, and additional supports are needed to improve the sharing of health information. To address the lack of continuity in care, a research team from the University of Illinois Chicago is collaborating with Special Olympics International in conjunction with HealthOne Global, a technology company, to adapt and test a personal health record (PHR) meant to meet the needs of people with ID. The PHR, known as the Personal Health Record for Adults with Intellectual Disabilities (PHR-ID), gives caregivers and health care providers access to longitudinal data on an individual with ID and provides alerts on action items in the individual's action plan.

The PHR-ID was built from the Special Olympics Healthy Athletes software database, which includes screening, demographic, and health history data. The first phase of the project was to gather input through focus groups and health care provider interviews to refine and finalize the PHR-ID content. Interviews with health care providers who specialize in the care of people with ID established requirements for the prototype system. Focus groups of adults with ID and their caregivers reviewed proposed interface design and discussed expectations of a PHR. During the second phase, a 3-month feasibility study was conducted to assess the usability, perceptions, and impact of the PHR-ID by caregivers and health care providers. The project will support the development of an infrastructure that provides guidance to caregivers and health care providers as they follow a customized critical care pathway for individuals with ID, thereby improving the coordination and quality of care.

Specific Aims:

- Adapt and refine an Internet-based PHR for adults with ID to share Special Olympics Healthy Athletes medical and health screening data with caregivers and health care providers. **(Achieved)**
- Conduct a feasibility study to examine the usability and user satisfaction of the PHR-ID in sharing electronic health information derived from the Special Olympics Healthy Athletes screening program with caregivers and health care providers. **(Achieved)**

2011 Activities: The pilot study of the PHR-ID concluded in 2011. A total of 39 families participated, and of those 16 viewed the PHR. As part of their participation in the pilot, families were asked to fill

out the PHR-ID Usability Pre-Survey. At the conclusion of the pilot, an intervention study was initiated. Caregivers responsible for adults and children with ID were asked to view the PHR-ID weekly. At the end of the study, parents were asked to talk to their son's or daughter's primary provider to review the PHR-ID together. The PHR-ID is available through a universal serial bus (USB) interface, allowing participants to bring this USB drive with them to visits with their son's or daughter's provider. Participants filled out the online PHR-ID Usability Post-Survey. The content of the survey was similar to the PHR-ID Usability Pre-Survey with a few additional questions regarding parents' or caregivers' acceptance of the PHR-ID, involvement of the Special Olympics athlete (son or daughter) in viewing the PHR-ID, and the experience of caregivers when they approached the health care provider to view the PHR-ID. A semi-structured interview guide was developed for interviewing caregivers who have completed the study. Interview questions are related to barriers and facilitators to PHR-ID use, home access to the PHR-ID, PHR-ID interface and usage, Internet use and clinical workflow patterns, and general feedback. These interviews will begin in 2012. In addition, caregivers will be asked to interact with the PHR-ID during the interview and to vocalize their thoughts and actions as they complete various activities.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project spending is roughly on target.

Preliminary Impact and Findings: Forty-one percent of participants viewed the PHR-ID in the pilot, with views ranging in number from one to nine. Preliminary analysis of the pilot phase data indicated the PHR-ID Usability Survey scales had good-to-moderate inter-item correlation. Additionally, one of the major PHR-ID Barrier Survey items endorsed by participants was, "I do not have time to use the PHR-ID." This comment supports the comments from families who were nonresponders about being too busy or overwhelmed to participate.

In the intervention phase, 35 percent of participants viewed the PHR-ID, with views ranging in number from one to four. Similar to the pilot phase, participants endorsed as one of the top three barriers, "I do not have time to use the PHR-ID." Two participants visited a health care provider and eight indicated interest in completing the optional semi-structured phone interview. A secondary finding was that the use of the USB drive as the data storage of the PHR was problematic for several reasons. For some families, it was not compatible with their home computer, and for clinicians, the USB created concerns about transfer of viruses if it was to be used on their office computers. The research team also learned the importance of engaging the patient through the PHR-ID by making it interactive.

Target Population: Persons with Disabilities*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Testing Clinical Decision Support for Treating Tobacco Use in Dental Clinics

Principal Investigator:	Shelley, Donna, M.D., M.P.H.
Organization:	New York University School of Medicine
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 021002
Project Period:	September 2011 - September 2013
AHRQ Funding Amount:	\$171,412

Summary: Smoking remains the leading preventable cause of death in the U.S. Research shows that smoking cessation can reduce the risk of lung cancer and other diseases by 20 to 90 percent. The U.S. Public Health Service Guidelines have established that tobacco dependence treatment, including cessation pharmacotherapy and brief counseling, can produce significant and sustained reductions in tobacco use and should be delivered to all smokers seeking routine health care. Dentists are in a good position to provide tobacco cessation treatment because: 1) they have regular access to a broad population (50 percent of current smokers report at least one annual dental visit); 2) they have access to patients who do not receive other health care services (10 percent of dental patients do not see a physician regularly); 3) multiple patient dental visits per year are common, allowing for repetitive dental provider opportunities to offer tobacco cessation counseling and interventions; and 4) evidence shows that tobacco cessation assistance delivered by dental providers can increase tobacco cessation. Currently, however, dentists generally do not provide routine tobacco cessation treatment to their patients who smoke. Dentists often cite barriers—such as concern about increased patient visit time, limited training in behavioral assessment and intervention, a lack of office-based systems to facilitate preventive care, and a lack of referral resources—to providing cessation treatment.

Dr. Donna Shelley and her research team are working to address these barriers. They are implementing a clinical decision support system that uses a previously developed smoking cessation personal digital assistant (SC-PDA). This system involves the use of a handheld PDA to help dentists provide evidence-based guidelines on smoking cessation during patient encounters. Based on the patient information entered, the system helps dentists recommend and prescribe approved pharmacotherapy; facilitates referral of patients to local counseling resources; prints handouts with patient-specific smoking cessation recommendations, instructions, and cessation resources; and documents the visit for the patient's dental record.

This study is using a cross-sectional pre-post study design to assess the impact and acceptability of the SC-PDA. The intervention is being implemented in six general dental care clinics including five New York University College of Dentistry clinics and the Institute of Family Health, a federally-qualified dental health center. Each clinic uses a tobacco use identification system (TUID) to identify patients who are eligible for the study. Patients who consent to the study are administered an exit survey after their dental visit to collect baseline data on dentist adherence to the Public Health Service Guidelines and on patient quit behavior. After collecting baseline data, dentists in all six clinics receive training on the

SC-PDA. Two weeks after implementation, clinics again use the TUID to identify patients for the study. Exit surveys are administered to collect data from patients during the intervention period of the study. At the end of the intervention, the research team plans to conduct focus groups with staff from the six clinic sites to collect data on use and acceptance of the SC-PDA.

The SC-PDA is a promising tool to help dentists provide evidence-based smoking cessation assistance. This study will provide an initial assessment of its potential impact and use and will inform future testing and implementation of the SC-PDA in dental health clinics throughout the U.S.

Specific Aims:

- Test the hypothesis that a clinical decision support system will improve the rate at which dentists assist their patients with smoking cessation by providing information and recommendations on smoking cessation resources. **(Ongoing)**
- Assess whether exposure to information and recommendations facilitated by the SC-PDA will: 1) increase the rate at which patients make at least one quit attempt in the month following the dental visit; and 2) increase the reported use of counseling and pharmacotherapy during those attempts over that observed with a tobacco use identification system alone. **(Upcoming)**
- Evaluate the acceptance of the SC-PDA into the workflow of dental clinics through semi-structured interviews of dentists and focus groups with staff at the conclusion of the trial, and by measuring the range of use of the SC-PDA with a log on the server that collects aggregate data of each dentist's access of specific PDA screens by time. **(Upcoming)**

2011 Activities: During the last quarter of 2011, the team revised and updated the SC-PDA tool. The tool was tested in one clinic and is ready for implementation. Participant recruitment was initiated at two of the six dental clinic sites to collect baseline data on provider adherence to tobacco use treatment guidelines.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is roughly on target.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

Barriers and Facilitators to Implementation and Adoption of EHR in Home Care

Principal Investigator:	Sockolow, Paulina, Dr.P.H., M.B.A., M.S.
Organization:	Drexel University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (R21)
Grant Number:	R21 HS 021008
Project Period:	September 2011 - September 2013
AHRQ Funding Amount:	\$162,740

Summary: As demand for home care services increases to support the health care needs of our aging population, more home health agencies in the United States are implementing electronic health records (EHRs). Home care using skilled nursing services is an increasingly important and effective way to deliver care and manage chronic illnesses in the growing older population. Good communication regarding patient data, status, and care plans is essential for ensuring efficiency, patient safety, and quality of care. An EHR at the point-of-care, in this case, at the home, would facilitate communication and enable access to updated patient health information in a timely fashion. If patient data are integrated and available in real time, a home care EHR has the potential to improve health care decisionmaking and outcomes.

The impact of implementing EHRs in hospital and ambulatory care settings has been studied, but little research has been done on implementing EHRs in home care settings. To address this research gap, Dr. Paulina Sockolow and her research team are conducting a study involving interrupted time-series analysis to assess the impact of a point-of-care home based EHR. This EHR was implemented in 2009 at Penn Care at Home, a nonprofit freestanding home care agency in Philadelphia that provides services to 1,200 patients a month in a five-county area. Retrospective and prospective quantitative data are being collected to understand how EHR implementation affects patient, workflow, and financial outcomes. Qualitative survey and interview data and quantitative EHR-use data will be collected to describe the barriers and facilitators of EHR adoption by home care providers. All Penn Care at Home clinicians who provide direct patient care and document in the EHR, and data from all Medicare patients cared for by the home care nurses will be included in this study. The research findings will inform the development of home care EHR design and implementation recommendations.

Another component of this study involves comparing the home care EHR functionality with ambulatory EHR functionality, as specified in the Department of Health and Human Services Final Rule on Meaningful Use Stage 1 objectives. The home care EHR functionality will be based on the qualitative data collected from home care clinicians' perspectives on EHR functionality, and on qualitative functionality data collected from the EHR documentation. This comparison will result in policy recommendations from the research team on developing Meaningful Use criteria specific for home care EHRs.

Quantifying the impact of the EHR and identifying EHR characteristics associated with better adoption and clinical outcomes will help to inform improvements in home care EHR development, implementation, and training.

Specific Aims:

- Examine the impact of EHR implementation in a home care agency by comparing patient, workflow, and financial outcomes before and after point-of-care EHR implementation. (**Ongoing**)
- Identify the barriers and facilitators to point-of-care EHR adoption and implementation in home care. (**Upcoming**)
- Propose design, implementation, and policy recommendations that address the barriers and facilitators to implementation and Meaningful Use of the EHR in home care. (**Ongoing**)

2011 Activities: Activities centered on data extraction and analysis of the patient, workflow, and financial outcome components of the project. Analysis of the workflow and financial outcomes before and after home care EHR implementation is almost complete and manuscript writing on the analysis and findings is in process.

As last self-reported in the AHRQ Research and Reporting System, project progress and activities are completely on track and the project budget funds are somewhat underspent due to a pending invoice for programming.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Elderly,* Medicare

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Use of HIT to Increase Primary Care Access in Medicaid Patients

Principal Investigator:	Wexler, Randell, M.D., M.P.H.
Organization:	Ohio State University
Mechanism:	PAR: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality through Health Information Technology (IT) (R21)
Grant Number:	R21 HS 020693
Project Period:	September 2011 - August 2013
AHRQ Funding Amount:	\$300,000

Summary: Hospital emergency departments (EDs) are often used for non-urgent or routine health services, which can result in considerably higher health care expenditures than services provided in a primary care setting. For patients covered by Medicaid, ED visits as a proportion of all ambulatory care visits are more than double the proportion for those with private insurance. The Patient Protection and Affordable Care Act is projected to increase the number of patients receiving Medicaid coverage by 16 million. Because the biggest users of ED services are people covered by Medicaid, the project team is using education and programs to direct this population to appropriate health care services in an effort to bring their usage of the ED in line with other users.

This research project seeks to develop, implement, and evaluate an Emergency Department-Primary Care Provider (ED-PCP) Connector program to improve access to primary care for Medicaid patients and improve coordination of care across transitions in health care settings. The ED-PCP Connector program is innovative in its use of health information technology (IT) to facilitate and improve patient access to care by scheduling patient followup in real time and providing PCPs with access to patients' medical records through a functional electronic health record (EHR) system that can connect the hospital ED to PCP offices.

In a randomized controlled trial of this intervention, study staff will test whether the program makes a difference in quantitative and qualitative assessments, including measures of ED utilization, assessments of patient satisfaction, and evaluations of physicians' opinions about the program's ability to improve communication between the ED and PCP settings.

All subjects will be surveyed regarding satisfaction with the process. In addition, the team will follow all subjects for primary care and ED use during the study period. There will be three phases to this proposed research: 1) development; 2) implementation; and 3) evaluation.

Specific Aims:

- Develop, implement, and evaluate an ED-PCP Connector program using a health IT-based intervention to reduce ED utilization and increase primary care access for Medicaid patients who do not have a regular source of primary care. **(Ongoing)**
- Improve Medicaid patients' satisfaction with care and improve communications between the ED and PCPs through use of an ED-PCP Connector program. **(Ongoing)**

2011 Activities: The study began in the last quarter of 2011 and the research team focused on start-up activities. During this period, several key steps were developed, including material development and documentation for institutional review board; review of the EHR electronic scheduling system to develop a referral mechanism for patients; development of a study-specific database to track activities and data points of the study; processes to permit study-data collection at the baseline, 6-week, 6-, and 12-month periods; and the adaptation of both the client satisfaction questionnaire and multi-dimensional Health Locus of Control Scales Form A survey.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track and the project budget is roughly on track.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Medicaid

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Use of Affordable Open Source Systems by Rural and Small-Practice Health Professionals

Principal Investigator:	Williams, Laurie Ann, Ph.D.
Organization:	North Carolina State University, Raleigh
Mechanism:	RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (R21)
Grant Number:	R21 HS 018218
Project Period:	September 2009 – September 2012
AHRQ Funding Amount:	\$299,078

Summary: National efforts focus on improving medical quality and reducing costs by implementing standardized electronic health records (EHRs), which can support the secure exchange of health information between different systems. However, rural health care providers and providers with small practices may not have the financial resources or expertise to purchase and maintain expensive hardware and software applications to participate in this effort.

Dr. Williams and her research team seek to meet the EHR application needs of rural and small-practice ambulatory health care providers throughout the United States using open-source EHR applications that are reliable, secure, confidential, standards and regulations-based, and able to be integrated with other health care systems. Hardware and software installation, usage, and maintenance costs will be optimized to maintain affordability.

The research team has conducted telephone interviews to assess the needs of rural and small practice doctors and is also making detailed assessments of promising open-source EHR applications. These assessments evaluate the functionality, trustworthiness, interoperability, performance, compliance, and affordability of open-source EHRs. In addition, the research team is developing an automated testing process that software engineers can use to evaluate existing open-source EHR applications and remove faults and vulnerabilities.

Ultimately, the team hopes to implement servers using open-source EHR applications that enable rural and small medical practices to obtain the benefits of EHR technology. However, even if promising open-source EHR applications are not identified, the platform being developed will function as a testbed system so that practitioners and their support staff or other researchers can continue to research a variety of health care applications.

Specific Aims:

- Conduct an assessment of the needs of rural and small-practice doctors with regard to the capabilities, strengths, and limitations of existing open-source EHR applications. **(Achieved)**
- Identify and evaluate promising open-source EHR applications. **(Ongoing)**
- Develop and disseminate a process for evaluating the functionality, trustworthiness, interoperability, performance, compliance, and affordability of existing open-source EHR applications. **(Ongoing)**
- Advance software engineers' understanding of best practices for developing new or enhancing existing EHR applications. **(Ongoing)**

- Implement servers using open-source EHR applications that enable rural and small medical practices to obtain the benefits of EHR technology as they run their offices and securely store, utilize, and share patient data. **(Ongoing)**

2011 Activities: The research team continues to work on developing a standardized approach for an automated testing process to examine whether an application is compliant with requirements of the Security Rule under the Health Insurance Portability and Accountability Act (HIPAA). These procedures will use open-source technologies so that software engineers can adopt these procedures to test their own EHRs. However, in fall 2011, the research team realized that there is no comprehensive set of test cases to make sure an application is HIPAA compliant, which would have allowed them to build their testing process. Instead they will develop a process to do a partial test for basic HIPAA compliance, which could eventually be expanded. This process will provide an outline for a more comprehensive set of test cases for HIPAA. The research team also continued to conduct security testing of open-source systems. However, a secure open-source system has not yet been found.

The research team continues to work on the physician needs assessment. Data collection for the physician needs assessment was completed in 2010 and included physicians and support staff from four practices. Research results were presented in a poster in December 2011 and Dr. Williams continues work on a manuscript.

The project team made some changes to the virtualized platform developed in 2010, through which practitioners and their support staff or other researchers can access and conduct research on five different health care applications. Changes were made to remove any possible interaction between the EHR images of the different applications.

The team also performed some research indicating that the logging provided by open-source electronic health records is inadequate. They published a paper detailing this research, to be presented in early 2012.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track. The project budget funds are somewhat underspent, and will be used to support additional time for student researchers. Due to the mid-semester start and end dates of the grant, a 1-year no-cost extension will be used. Students were hired to work on the automated testing process and to develop a portal for software engineers and health care IT staff that will include papers, links, information on meaningful use and missed criteria, plus a discussion forum.

Preliminary Impact and Findings: The research team presented a paper at the 2012 International Health Informatics Symposium demonstrating that the logging provided by three open-source electronic health records is inadequate, and as such that EHR systems remain vulnerable to undetected misuse. In this paper, the research team recommends that EHR system developers focus on specific auditable events for managing protected health information, instead of general events derived from guidelines.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Computer Assisted Medication and Patient Information Interface

Principal Investigator:	Ziemer, David C., M.D., M.P.H.
Organization:	Emory University
Mechanism:	RFA: HS08-269: Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (R21)
Grant Number:	R21 HS 018236
Project Period:	December 2009 – September 2012
AHRQ Funding Amount:	\$299,998

Summary: Although many studies show that the complications and costs of diabetes can be reduced by controlling glucose and other risk factors, many people with diabetes do not achieve good control of these factors. Further, there is often a breakdown in information flow between patient and provider. Inadequate information from patients, particularly in the areas of medication adherence and associated adverse events, can lead providers to make poorly-informed clinical decisions and provide inadequate or unclear instructions for patients. The goal of this Computer Assisted Medication and Patient Information Interface (CAMPII) project is to develop and test a tool to improve and standardize the flow of information between patients with type 2 diabetes and providers, thereby improving treatment outcomes and reducing complications.

The research team developed a touch-screen computer interface that patients at Grady Health System Diabetes Center, a municipal hospital specialty clinic, can use in to report medication information and adverse drug interactions, including hypoglycemia. The patient information interface is designed to collect complete and accurate information so providers can make informed therapeutic decisions for their patients who have diabetes and the associated major cardiovascular risk factors.

A provider medication interface was developed to improve the clarity and accuracy of the information received by providers and the quality of information shared with patients and other providers, with a particular focus on providing clear, detailed instructions, and motivational information to patients. The provider interface is designed to support medication management functions, including medication reconciliation, printing of medication instructions, and production of a daily medication schedule for patients.

A full interface evaluation will compare the completeness and accuracy of medication information obtained by traditional and computer-assisted methods with the reference-standard of a comprehensive multi-source interview by an experienced pharmacy expert. The research team will also assess the accuracy, acceptability, efficiency, and utility of the patient information interface for both providers and patients in a study population of type 2 diabetes patients.

Specific Aims:

- Develop an accessible information computer interface in a municipal hospital diabetes clinic that patients can use to report medication information and adverse drug interactions. **(Achieved)**
- Develop a provider medication interface to support medication management functions. **(Achieved)**

- Assess the accuracy, acceptability, time efficiency, and utility of the information interface for both providers and patients. **(Ongoing)**

2011 Activities: Design of the provider medication interface was completed in spring 2011. The patient interface was completed in September 2010 and enhanced in June 2011 before the randomized trial. The patient interface is designed for a full size touch-screen PC with a 20-inch monitor. Patients touch large onscreen buttons and thus there are only minimal dexterity and hand-eye coordination requirements for users. Voice-over instructions and reading of options minimize literacy requirements.

Data collection was completed in fall 2011, at which time Dr. Ziemer began work on data analysis, synthesis, and reporting. This includes data quality and data management activities, review of outcomes and identification of key questions, and planning for final publications and reporting.

A total of 239 subjects were recruited, 221 of whom completed the intervention. While the original study plan called for 75 study subjects, some new questions were added to the patient interface and the protocol was modified to allow focused testing of hypoglycemia questions, which required additional subjects to provide the necessary evidence and power for review. These changes were adopted with intuitional review board approval. Through followup phone interviews, the research team asked patients a few additional questions about their medication list. Medication lists were printed for patients enrolled in the computerized portion of the study, while patients enrolled in the paper-only portion were given paper so that they could write the information. Patients enrolled in the usual care portion were not involved in either process. Between 2 and 6 weeks later, team members asked patients in the computerized and paper-only portions to try to find their medication lists and to confirm one or two of the medicines on the list.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and spending is roughly on target. Due to initial staffing challenges related to timing of the grant start date, the project team is using a 10-month no-cost extension to support data analysis and reporting of trial data.

Preliminary Impact and Findings: Preliminary data strongly suggest that the touch-screen CAMPII method is more sensitive for detecting and recording hypoglycemia than provider documentation in the medical chart or patient documentation on the paper forms. CAMPII is also better than the chart or standard forms for identifying associated adverse events.

CAMPII computer-assisted self-interview is better for detecting hypoglycemia than chart documentation, is more specific than paper forms, and, from the provider perspective, was also a more efficient tool than usual care.

Target Population: Adults, Chronic Care*, Diabetes, Racial or Ethnic Minorities*: African-American

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Project ECHO: Hepatitis C Ambulatory Care Quality Improvement in New Mexico Through Health Information Technology

Principal Investigator:	Arora, Sanjeev, M.D.
Organization:	University of New Mexico
Mechanism:	PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018171
Project Period:	July 2009 – June 2012
AHRQ Funding Amount:	\$1,199,696

Summary: This project builds on the work of [Project ECHO: Extension for Community Healthcare Outcomes](#), which was previously funded by the Agency for Healthcare Research and Quality. Providers require access to patient-specific information to consult on cases, track patient progress, and evaluate clinical outcomes. At Project ECHO's inception, community-based providers transmitted patient-specific information to specialists via a data management system. Data were entered and stored locally on a laptop, transmitted via a secure virtual private network (VPN), and maintained in a centralized Health Insurance Portability and Accountability Act-compliant structured query language database server to support both clinical and research activities. With Project ECHO's rapid expansion, this type of data management proved inadequate because it presented numerous insurmountable barriers to site maintenance, VPN problems, and critical datafeed and reporting inadequacies.

To address these issues, Project ECHO will use an Internet-based clinical management system for patients undergoing treatment for hepatitis C virus (HCV). This system will improve quality of care, and lead to greater knowledge sharing among health care providers for rural and underserved populations. The enhancements to the electronic disease management tool, iHealth, and the clinical management system will standardize data collection, provide practice support, create a central data repository, and allow authorized personnel to view individual patient records. The iHealth tool will be accessed as a Web portal, the central identity for the HCV program, providing a single-access point for its resources. The portal includes search tools that program personnel can use to extract data for monitoring data quality, profiling, quality improvement, and research. Laboratory data from TriCore Reference Laboratories (TriCore) will be uploaded automatically into patients' electronic health records.

The underlying iHealth architecture supports effective management of patient data across multiple provider organizations. Web portals for patients will provide educational links and allow patients to see their summary reports, facilitating better communication with their providers. The provider portal can provide tools for HCV treatment and coordinate training activities. Patient needs will be assessed and determined via patient focus groups.

Specific Aims:

- Develop a disease management tool that will standardize data collection, provide practice support, create a central data repository, and allow authorized personnel to view individual patient records. **(Achieved)**

- Develop a Web portal that creates a central identity for the HCV program and provides a single-access point for its resources. **(Ongoing)**
- Create search tools that program personnel can use to extract data for monitoring data quality, profiling, quality improvement, and research. **(Ongoing)**
- Develop a system that automatically uploads laboratory data from TriCore. **(Achieved)**
- Promote adoption of iHealth clinical management system. **(Ongoing)**

2011 Activities: Disease management tools were developed during the year. There are two safety reports. One is automatically-generated based on audit parameters that are established clinical criteria; the other is a safety report that can be generated by anyone with appropriate authorizations to query certain clinical parameters. The final iteration of the HCV summary report is in the software that tracks clinical data over time during the patient's course of HCV treatment.

The following practice support tool has been developed: An internal calendar that identifies future dates for clinical encounters and labs that must be obtained for compliance with best-practices protocols. Adverse-event identification is accounted for in the safety report.

The provider portal was completed and includes links to provider educational resources including clinical protocols, National Institute on Alcohol Abuse and Alcoholism guides for alcohol interventions, and ongoing clinical trials. Functions to strengthen learning and enhance clinical decisionmaking, including non-identified patient-mirrored cases to enhance learning loops, have been developed. An interface with the iECHO partner relations management tool is being developed for didactics, continuing medical education, and other training functions.

It is now possible to obtain a subset of data from the database to develop outcome studies. Concerns regarding institutional review board and confidentiality have led the team to believe that this should not be a Web-based functionality at this time, and have opted for a human interface.

The first extracted data set was used for research and the [results](#) were published in June in the *New England Journal of Medicine*. This functionality can be provided to any researcher meeting authorization requirements. The roll-out of iHealth clinical management system was initiated.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget funds are somewhat underspent because of delays in staff hiring.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: Adults, Chronic Care*, Hepatitis C

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

The Medication Metronome Project

Principal Investigator:	Atlas, Steven J., M.D.
Organization:	Massachusetts General Hospital
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018648
Project Period:	September 2010 – July 2013
AHRQ Funding Amount:	\$1,151,054

Summary: One goal of primary care is to reduce the morbidity and mortality of chronic diseases such as hypertension, type 2 diabetes, and hyperlipidemia. However, national and local data indicate that the United States health care system is falling significantly short of evidence-based goals for these three conditions, both in terms of risk-factor control and in monitoring adverse drug events. Novel uses of health information technology (IT) are needed to support more effective medication management for chronic diseases in the primary care setting.

The Medication Metronome Project is testing a model of chronic disease medication management in which specific clinical actions, such as the decision to initiate or adjust medications, are performed independently of the office visit. The study is implementing a randomized controlled trial using an existing electronic health record (EHR) at Massachusetts General Hospital (MGH) to evaluate the value of an IT system that supports between-visit medication safety monitoring and dose adjustment. This “Medication Metronome” is designed to enable providers to schedule future laboratory tests related to a specific set of medications for glycemic, cholesterol, and blood pressure management. As these lab test dates become due, the Medication Metronome system reminds patients via letter and informs providers when the tests are “missing.”

The goal of this intervention is to implement an efficient, visit-independent system to ensure that patients are rapidly and safely brought to evidence-based treatment goals and to prevent delays in planned laboratory monitoring. This will be achieved through an iterative process of medication adjustments so that risk-factor control is not entirely dependent upon face-to-face office visits. The broader goal is to foster greater patient-physician connectedness by combining independent medication management with more productive visit-based care. This research is relevant to nationwide efforts to demonstrate the most effective ways to implement new IT-based delivery models that expand care beyond the traditional clinic visit.

Specific Aims:

- Develop the Medication Metronome system. **(Ongoing)**
- Conduct a randomized controlled trial of the Medication Metronome system. **(Upcoming)**
- Evaluate the impact of the Medication Metronome visit-independent care model on both the frequency and content of office-based visits. **(Upcoming)**

2011 Activities: The focus of activity was on the development of the Medication Metronome health IT system. This has involved both health IT development and qualitative evaluation of design prototypes to create a system that supports timely medication intensification, improves safety, and meets both patient and provider needs. In April and May 2011, iterations of the system architecture with mock-ups of the user interface were presented to the project’s primary care external advisory board, a group of practice providers representing all 12 primary care practices within MGH’s primary care Practice Based Research Network. An all-investigator research meeting was also convened in June to review feedback from clinicians.

Since then, a medication prescription user interface has been developed to ensure compatibility among Metronome-identified clinics. A key requirement for implementation of the Medication Metronome system is the implementation of computerized laboratory order entry into these practices. The project team has been working on the interface to ensure that electronically generated laboratory slips match the MGH blood laboratory knowledge base. Development of the orders module was completed at the end of 2011, with final testing and planned release in early 2012.

As last self-reported in the AHRQ Research Reporting System, the progress and activities are completely on track and project budget funds were moderately underspent. Initial underspending was related to the 10-month budget in the first year of the project and the short time frame from notification of grant award and time associated with billing for personnel costs for work performed. Spending is anticipated to increase in upcoming quarters as several project activities commence. The project team anticipates that all approved funds will be spent upon successful completion of the project.

Preliminary Impact and Findings: The project has no findings to date. However, feedback from the clinician training sessions resulted in the addition of the “Do Now” function, a key design update. This function allows a patient who is in the doctor’s office for another reason, on a day close to the original laboratory due date, to change the due date to the current day to have their blood drawn “early” and more conveniently. Clinicians believe this feature has potential to increase blood-draw compliance.

Target Population: Chronic Care*, Diabetes, Hypertension

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

* This target population is one of AHRQ’s priority populations.

Technology for Optimizing Population Care in a Resource-Limited Environment (TOP-CARE)

Principal Investigator:	Atlas, Steven J., M.D.
Organization:	Massachusetts General Hospital
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018161
Project Period:	December 2009 – November 2012
AHRQ Funding Amount:	\$1,199,264

Summary: In recent years, many organizations have designed health information technology (IT) initiatives to help provide consistent, high-quality care to everyone, thereby improving health care in the primary care setting. Despite the increasing adoption of basic health IT capabilities, studies continue to reveal low rates of appropriate preventive screening. The Technology for Optimizing Population Care in a Resource-Limited Environment (TOP-CARE) project is working to design, develop, and implement a novel cancer screening intervention program. The goal of this study is to improve clinical decision support and enhance preventive cancer screening. The screening program is being integrated with electronic health record (EHR) data to assess whether clinical decision support can efficiently enhance preventive care—specifically, breast, cervical, and colorectal screening—in a primary care setting.

User feedback, particularly from key stakeholders such as primary care physicians, practice contact delegates, patient navigators, and central administrative personnel, is critical to guide the successful design of the TOP-CARE system. A practice cluster randomized trial of the TOP-CARE program will provide an opportunity to assess its impact on cancer screening rates in eligible patients. Practices within the Massachusetts General Primary Care Practice Based Research Network (MGPC-PBRN) will be randomly assigned to intervention or augmented standard care. This randomized clinical trial uses tailored outreach, including letters and practice personnel or patient navigator contact to see whether screening rates differ when outreach is linked to the patient’s needs. The control group receives a standard of augmented care that mimics current population-level reminder systems, supplemented by the use of automation.

Using average cancer screening test completion rates for breast, cervical, and colorectal cancers, Dr. Atlas and his research team will demonstrate the use of a state-of-the-art approach to automated, cancer-specific patient reminders and its impact on involving clinicians in patient population management to facilitate between-visit, patient-centered cancer screening. This research is relevant to nationwide efforts to rigorously demonstrate the most effective ways to implement new IT-based delivery models.

Specific Aims:

- Design, develop, and implement a novel cancer screening intervention program (TOP-CARE) that facilitates the identification, individualized contact, and subsequent tracking of patients overdue for screening. **(Achieved)**

- Conduct a practice-randomized trial of the TOP-CARE program within the MGPC-PBRN assessing its impact on cancer screening rates in eligible patients. **(Ongoing)**
- Collect data prospectively throughout the randomized trial on costs, preferences, and clinical and process outcomes to inform a subsequent formal cost-benefit analysis. **(Ongoing)**

2011 Activities: Activities focused on the development and implementation of the TOP-CARE intervention. The randomization scheme and randomization of practices to the intervention or the automated control arm was completed in March 2011. In May, the functionality and quality control testing on the system was completed. The project team conducted data quality testing in which a comprehensive data reconciliation process was conducted between the live system in production and the retrospective data collection to identify any causes of discrepancies. During this same period, the TOP-CARE beta application was rolled out to a pilot site (Ambulatory Practice of the Future) for additional usability testing. Training sessions were provided to all primary care practices involved in the study and users of the applications—primary care physicians (PCPs), delegates, practice managers, and administrators—received more intensive training. Overview and training of the applications for PCPs and practice population managers were completed in all nine intervention and all nine control practices. On June 15th, 2011, the TOP-CARE application was launched on schedule.

Meanwhile, the study team continues to improve the TOP-CARE applications based on user feedback received after the initial launch. Training of existing navigators was completed in August. In September, all practice population managers were emailed offering a followup training session and the opportunity to meet the TOP-CARE navigator. Brief meetings were held in five intervention practices to introduce the patient navigation.

To identify the variables necessary for the cost analyses, a survey instrument for PCPs, practice delegates, and navigators was developed. The survey was administered in paper form to PCPs and practice delegates during initial meetings and training sessions. The survey will be re-administered after the completion of the randomized controlled trial.

As last self-reported in the AHRQ Research Reporting System, project progress, activities, and budget spending are completely on track.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Improving Uptake and Use of Personal Health Records

Principal Investigator:	Bates, David W. M.D., M.Sc.
Organization:	Brigham and Women's Hospital
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018656
Project Period:	April 2010 – March 2012
AHRQ Funding Amount:	\$862,047

Summary: Personal health records (PHRs) offer patients new ways to participate in their health care. Yet while studies have found a high degree of patient interest in PHRs, actual adoption rates are low and when PHRs are adopted, improvements in patient quality-of-care have not been documented well. Previous studies focused on the satisfaction of current users but did not fully describe how a patient decides to use a PHR. Researchers do not understand strategies that provider organizations can use to encourage and support PHR adoption and use among patients.

This project takes a comprehensive approach to studying adoption of PHRs using the Diffusion of Innovation Framework that Everett Rogers developed. This framework assists in understanding the factors that influence adoption by studying the different stages—including the perceived attributes of the PHR, attitudes toward adoption of PHRs, and the impact of perceptions and attitudes on behavioral intentions as well as actual behaviors—of the innovation-decision process. The project introduced the PHR in four selected primary and specialty care practices (two controls and two active intervention practices) to study the impact of multi-intervention strategies on uptake and continued use of the PHR. Each practice determined its own strategies, which included patient education about the PHR provided by clinic staff, supporting patients in PHR registration and use, and use of a computer kiosk in the waiting room for patient self-enrollment. The investigators are assessing the facilitators and barriers to adoption, implementation, and use of the PHR at the organizational and patient levels, and are evaluating the impact of the intervention on adoption and usage rates. The final task is to assess the impact of the PHR on the quality of care as measured by a patient survey on patient-centeredness and through a set of quality measures on health outcomes.

This research will contribute to knowledge of how to encourage use of PHRs and, once adopted, how to increase their impact on quality of care.

Specific Aims:

- Introduce an intervention employing multiple strategies to improve the uptake and use of PHR in an ambulatory setting. **(Achieved)**
- Evaluate individual and organizational-level facilitators and barriers associated with PHR adoption and implementation. **(Ongoing)**
- Assess the impact of the intervention on awareness, adoption rates, and use of the PHR. **(Upcoming)**
- Assess the impact of the interventions in improving quality of care. **(Upcoming)**

2011 Activities: The adoption intervention was implemented in the primary care and nephrology practices to improve patient uptake of the PHR. An “adoption survey” was sent to patients in the control

and intervention practices to assess their experience with signing up to use the PHR. Providers and staff were also surveyed. Following the adoption intervention, the use intervention was initiated in 2011 to identify various interventions to improve patients' PHR use. Data collection identified three types of patients: those who enrolled in the PHR but never activated their account; those who used the PHR for specific functions, such as viewing laboratory results but not for others such as secure messaging with their provider; and frequent users of the PHR. Intervention strategies targeted each group separately.

Patients who did not activate their accounts were encouraged to do so and to use the PHR. Patients who used the PHR for specific functions were encouraged to explore the PHR for additional functionality. The intervention materials for these groups comprised a letter from the medical director of the practice and a flyer highlighting different PHR functionalities. Patients who were frequent PHR users received an acknowledgement letter from the medical director of the practice and a pen with the practice logo as a thank-you.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget funds are somewhat underspent. The project is underspent due to a change in methodology for patient surveys and the departure of a co-investigator. Project spending is expected to resume to forecasted level in 2012.

Preliminary Impact and Findings: Adopters and non-adopters of the PHR were mailed surveys using Dillman's tailored design method approach. Unlike the telephone surveys, which were stopped because of low response rates, a good response rate (59 percent) was obtained by mailed surveys to adopters of the PHR (PHRA). In comparison, there was a 42 percent response rate among the non-adopters of the PHR (PHRNA). This is not surprising, given that nonadopters may be more reluctant to complete a survey on perceptions and attitudes of PHRs. PHRA assigned significantly greater values than PHRNA to the use of a PHR for communicating with their provider's offices for the following tasks:

- Appointment requests (Mean PHRA=7.3 versus Mean PHRNA=5.8)
- Medication refills (Mean PHRA=7.8 versus Mean PHRNA=6.2)
- Viewing laboratory results (Mean PHRA=8.5 versus Mean PHRNA 6.1)
- Viewing radiology results (Mean PHRA =7.8 versus Mean PHRNA 5.9)
- Asking a medical question (Mean PHRA =7.2 versus Mean PHRNA 5.6)

PHRA also showed significantly greater preferences for receiving health information via a PHR: 62 percent of PHRA would prefer to receive preventive care information via a PHR, compared to 32 percent of PHRNA; 65 percent of PHRA would prefer receiving patient education materials via a PHR, compared to 29 percent of non-adopters. Preliminary results suggest that PHRA value PHRs for patient engagement and effective communication and prefer the PHR for receiving information such as preventive care reminders and patient-educational materials.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Health Information Technology to Support Clinical Decision Making in Obesity Care

Principal Investigator:	Gance-Cleveland, Bonnie, Ph.D.
Organization:	Arizona State University - Tempe Campus
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018646
Project Period:	September 2010–July 2013
AHRQ Funding Amount:	\$496,977

Summary: Domestically, the prevalence of overweight youth has nearly quadrupled in the past four decades. This dramatic increase has led to the emergence of associated comorbidities such as dyslipidemia, hypertension, type 2 diabetes, musculoskeletal disorders, respiratory conditions, and emotional problems. In addition, there are increased risks of cardiovascular disease and cancer as these youth become adults.

The American Medical Association has published recommendations, and the National Association of Pediatric Nurse Practitioners has developed family-centered, culturally-sensitive clinical practice guidelines for obesity prevention among youth. However, past research suggests that guidelines rarely change clinical practice and outcomes. Health information technology (IT) may provide a mechanism to better implement these guidelines via decision support and tailored patient education materials.

Dr. Bonnie Gance-Cleveland and her research team have developed HeartSmartKids™, a computer support system for clinical decisionmaking and tailoring patient education to facilitate the translation of recommendations into practice. This study is employing a comparative effectiveness trial to evaluate HeartSmartKids with and without technology decision support on the implementation of the current guidelines at school-based health clinics for children ages 5 to 12. Outcome assessments will be conducted at the provider and system levels. The research aims to eliminate health disparities for the conditions related to childhood obesity via the translation of evidence-based guidelines into practice by the providers who care for youth at risk for these obesity-related conditions.

Specific Aims:

- Evaluate the effectiveness of Web-based training with and without computerized clinical decision support on provider's process and outcome behaviors related to implementing the current guidelines for prevention of obesity and related conditions. **(Ongoing)**
- Explore the role of health IT in the processes of system change for implementation of the guidelines for prevention of obesity and related conditions, including the facilitators, barriers, and impact of the care model on change. **(Upcoming)**

2011 Activities: Site recruitment and institutional review board (IRB) approval was a major focus of the project in 2011. To date, the research team has recruited 24 sites in six states. IRB approval has been obtained for 22 of the sites. Some of the sites accepted Arizona State University's (ASU's) IRB approval, while others required separate protocols. Among sites that did not accept ASU's IRB approval, some sites required one protocol while others required two protocols, one for the parent organization

and the other for the school district. In total, the project team wrote 17 IRB protocols. Of sites with IRB approval, 11 sites with 11 providers were randomized to the technology intervention arm, and the other 11 sites with 13 providers were randomized to the nontechnology control arm. Several of the sites that originally committed to study participation dropped out due to staffing changes, budget cuts, or competing demands. As a result, the project team will recruit two additional sites in 2012.

As IRB approval was received for each site, the study team initiated baseline data collection. This data collection process requires three discrete steps: 1) a provider satisfaction survey for each provider; 2) 32 chart audits at each site; and 3) 32 parent satisfaction surveys at each site. As of the end of 2011, surveys were completed by 22 providers, chart reviews were completed at 16 sites, and a number of parent surveys were completed at 10 of the sites. The parent surveys have been found to be the most challenging aspect of data collection, as children are not always accompanied by their parents at school-based clinics.

When baseline data collection is complete, iPads with the HeartSmartKids software will be mailed to the clinics. Providers are then trained to use the system. Of the six sites that have received the technology, five have installed the software. The project team reported that some sites have old computers that resulted in compatibility issues. Additionally, the computer skills of the staff were a barrier at a few sites. The HeartSmartKids staff and the IT support staff at the sites have worked closely to resolve these issues. Followup data collection will occur after the training and again at the end of the study.

An eLearning Web site for the Web-based training was developed and finalized. The purpose of the Web site is to teach providers about the program through four modules: 1) overview of recommendations; 2) motivational interviewing; 3) culturally-sensitive care and community collaboration; and 4) sharing lessons learned.

As last self-reported in the AHRQ Research Reporting System, the project is on track in some respects but not others. Progress is slightly behind schedule due to difficulties recruiting and retaining sites. Project spending is on target.

Preliminary Impact and Findings: Among providers who have begun the training, providers rated their satisfaction as good or very good. When asked what aspects of clinical practice they will change as a result of the training, responses included using more motivational interviewing to help families set realistic goals and following the recommendation for repeat laboratory tests when clinically appropriate.

Target Population: Obesity, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Information Technology Implementation by Cognitive Engineering of Organizational Routines

Principal Investigator:	Green, Lee A. M.D., M.P.H.
Organization:	University of Michigan at Ann Arbor
Mechanism:	RFA: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018170
Project Period:	December 2009 – November 2012
AHRQ Funding Amount:	\$1,199,139

Summary: Successful implementation of health information technology (IT) systems requires substantial attention to workflow processes. This project examines the change process that must occur for successful adoption of health IT and how to best reengineer workflows. The Department of Family Medicine at the University of Michigan and the Michigan Primary Care Association have identified three Federally-Qualified Health Centers (FQHCs) to implement Cielo Clinic™, a commercial clinical quality management system developed by family medicine physicians at the University of Michigan. The use of the Cielo Clinic™ is being tailored to each participating FQHC's interest and priorities. Through an iterative process, each clinic is choosing the screening, prevention, chronic disease management, and outreach components of the Cielo Clinic™ software that best fit their quality improvement priorities.

This project examines the change process needed for successful adoption of the quality management system using an advanced set of tools as part of cognitive task analysis to guide the implementation and reengineering work. Each practice included has an existing electronic health record (EHR), but EHR functional component use varies. Implementation focuses on training site staff to work in teams to understand and modify organizational routines using the Cielo Clinic™. Clinics are working on implementation until they achieve success, or until several plan-do-study-act cycles without progress make it clear that implementation will not succeed. Practices will be evaluated to determine whether the Cielo Clinic™ clinical system increases adherence to evidence-based practice and whether cognitive task analysis-guided implementation is advantageous to the health centers. The study is using a mixed-methods, stepped-wedge research and evaluation design to allow analysis of data across time within sites and to make across-site comparisons. The project will collect qualitative data on the implementation process, including the barriers and facilitators encountered, which will help health care leaders implement new technology in ambulatory safety net settings.

Specific Aims:

- Identify the barriers and facilitators to implementing clinical quality management systems in safety net ambulatory care settings. **(Ongoing)**
- Measure the impact of using cognitive engineering tools during implementation of a clinical quality management system (Cielo Clinic™). **(Upcoming)**

2011 Activities: Each of the three clinical sites implementing Cielo Clinic™ is in a different stage of the process. The first site has installed the Cielo Clinic™ software and the research team is currently

analyzing transcripts from their site visits. They are doing full transcription of the interviews to produce rich qualitative data. The second site plans to go live with the Cielo Clinic™ software early in 2012. Once the implementation date is scheduled, the research team will visit the clinic. The third site is about to begin and the project team is scheduling their first meeting with them for early 2012. The third site is unique because before participating in this research grant they attempted to implement Cielo Clinic™ and failed. The research team will help them work through the failure points in the previous implementation process.

As last self-reported in the AHRQ Research Reporting System, project progress is mostly on track and the project budget funds are significantly underspent. The implementation process of Cielo Clinic™ has been delayed at all three clinical sites for various reasons. The principal investigator is working with each site to overcome these challenges and is documenting these challenges as part of the research process.

Preliminary Impact and Findings: The results of cognitive task analysis interviews were presented to the clinic leadership. The cognitive task analysis discovered areas of reliance on tacit knowledge that have potential for significant implications for implementing health IT. For example, the cognitive task analysis revealed differing assumptions and expectations among providers who believed they were in agreement about guideline implementation.

The research team plans to write several papers describing the safety net environment for health IT. One specific component of the discussion will be the implementation of health IT by a safety net provider in comparison to an organization that has money for in-house consultants and Lean process thinking coaches. Other paper topics include description of the change management process and methodological approach of the research team.

Target Population: Medically Underserved, Safety Net, Uninsured

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Health IT Enhanced Family Health History Documentation & Management in Primary Care

Principal Investigator:	Haas, Jennifer S., M.D., M.S.P.H.
Organization:	Brigham and Women's Hospital
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018644
Project Period:	September 2011 - July 2014
AHRQ Funding Amount:	\$1,111,483

Summary: The growing understanding of the genetic and hereditary components to disease has increased the importance of information about family history as a component of a patient medical record. However, in the context of short primary care visits, full family histories accompanied by individual risk assessment are challenging for providers. Technology has the potential to improve the ability of providers to both capture this type of information and to estimate and provide guidance on health risks based on family history. This project is developing two methods to collect family health history as part of an integrated risk assessment module: 1) a telephonic interactive voice response system (IVRS) that uses a computer to detect voice during a normal phone call and encourages patients to provide their history through programmed questions; and 2) a Web-based tool with a series of questions. Patients will choose their preferred method and information gathered will be incorporated into the patient electronic health record (EHR). Based on reported family history, a computer server will summarize information into a risk assessment for patient and provider discussion. This will be paired with clinical decision support reminders to providers based on the assessment.

The integrated risk assessment module will be evaluated through a cluster randomized controlled trial of adult primary care patients in the Brigham and Women's Primary Care Practice-Based Research Network. The evaluation of this project will assess the ability of the module to reach a large number of patients, its effectiveness in improving personalized risk assessment and counseling, and the facilitators and barriers of adoption and implementation. The findings from this research will increase understanding about how technology can be used to improve collection of family health history information from diverse populations and be used to provide personalized risk assessment.

Specific Aims:

- Develop a patient-reported, EHR-integrated, personalized risk assessment module to provide tailored disease risk and risk reduction information for these four common conditions (breast cancer, colorectal cancer, coronary heart disease, and type II diabetes) for the patient and his/her primary care physician (PCP). **(Ongoing)**
- Measure the reach and effectiveness of this integrated risk assessment module by conducting a cluster randomized controlled trial of adult primary care patients in the Brigham and Women's Primary Care Practice-Based Research Network. **(Upcoming)**
- Evaluate facilitators and barriers to the adoption and implementation. **(Upcoming)**

2011 Activities: The research team began developing a risk assessment tool to incorporate both patient-reported family health history and lifestyle risk factors into a single tool to provide tailored disease risk and risk reduction information for the patient and PCP. An IVRS script and Web-based version of a risk assessment tool is being created based on Your Health Snapshot and the Surgeon General's My Family Health Portrait that will run on a secure site behind the health system's firewall. The IVRS and Web-based risk assessment surveys are being augmented through a literature review of metrics associated with lifestyle risk factors for the targeted diseases/conditions. For physicians, the team is developing a survey to measure self-efficacy for individualized risk assessment and patient counseling about personalized risk, and perceived barriers and facilitators to these activities in the primary care setting. The provider survey will be distributed at the end of the intervention to get feedback on the risk assessment tool. The team is developing a survey for patients to measure their personal assessment of risk for breast cancer, colon cancer, heart disease, and diabetes and the process of care for preventing these conditions.

There are two study arms. One consists of patients who will complete their history through robocalls and the integrated voice response; the other is patients who will complete their history through a personal health record. The research team is currently developing the tools and surveys to be used through each arm. The team has expanded the disease categories to include ovarian, prostate, endometrial, and lung cancer and is finalizing the risk assessment module of self-reported family health history and personal risk factors. The goal is to use these in a randomized control trial across Partners HealthCare primary care clinics. There are 16 clinics affiliated with the Brigham and Women's Hospital and the scheme is to have eight control clinics.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is on target.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Automating Assessment of Obesity Care Quality

Principal Investigator:	Hazlehurst, Brian L., M.A., Ph.D.
Organization:	Kaiser Foundation Research Institute
Mechanism:	PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018157
Project Period:	December 2009 – March 2013
AHRQ Funding Amount:	\$1,194,761

Summary: Obesity and its public health effects are an increasing burden on the health care system. This project proposes to develop, implement, and evaluate a routine, automated method to assess outpatient obesity care quality using measures from comprehensive electronic medical record (EMR) data based upon the National Heart, Lung, and Blood Institute (NHLBI) obesity care guidelines.

The study team is investigating associations between obesity care delivery steps and clinical outcomes known or suspected to be accelerated by obesity. Measures to evaluate the association include: reasons for visit; orders; referrals; diagnosis codes; vital signs; text clinical notes pertaining to weight (BMI) and weight loss counseling; and other obesity intervention efforts. The project team is using percent change in body weight as the primary outcome measure.

Retrospective EMR data from Kaiser Permanente Northwest (KPNW), a midsized health maintenance organization and Oregon Community Health Information Network (OCHIN), a consortium of federally-qualified health centers, is being used to evaluate the association between obesity guideline adherence and clinical outcomes. The project is using Kaiser Permanente's Epic-based EMR, HealthConnect, and OCHIN's EMR, EpicCare. Information from both structured and free-text fields will be used. Free-text fields are being automatically coded using natural-language processing computer software. Data produced under the automated method of quality measurement is being compared to medical record reviews performed by abstractors in order to assess the validity of the automated system.

The automated system is being applied to patient populations of KPNW and OCHIN, which total more than 350,000 adults to determine: 1) the proportion of overweight or obese patients who are receiving advice, counseling, weight-loss program referral, medication prescription, and other care recommended by the guidelines; 2) correlates of overweight and obesity diagnosis and treatment guideline adherence including patient characteristics, comorbidity status, provider characteristics, and health system characteristics; and 3) changes in health status as a function of guideline adherence for obese patients.

Specific Aims:

- Develop obesity care quality measures based on updated NHLBI guidelines to evaluate obesity care performance in primary care. **(Achieved)**
- Use comprehensive EMR data to develop and validate an automated (generalizable and scalable) method for applying the measures identified in the first aim. **(Ongoing)**
- Apply the method developed in the second aim to assess ambulatory obesity care quality in two distinct health plans representing diverse patient populations and care practices. **(Ongoing)**

- Evaluate the association between measures of obesity guideline adherence to recommended obesity care processes and clinical outcomes and provider characteristics. **(Ongoing)**

2011 Activities: Study staff identified the content-specific rules and codes required to distinguish the relevant clinical events (e.g., the order codes used at each site that indicate “obesity counseling”), and codified the text statements clinicians use to satisfy the measures (e.g., “advised pt to lose wt”). These statements are being built into the knowledge base of the automated program that identifies the relevant clinical events of the quality measure set.

An abstraction form and process were developed to enable chart review to validate the measures. A random sample of approximately 450 study patients, stratified by age, sex, and BMI, was selected at each site. Both KPNW and OCHIN chart reviews were completed with a 10 percent sample validation, using a practicing primary care clinician to ensure the quality of chart reviews.

Early in 2011, the project slowed significantly because the OCHIN study site was reworking their data-sharing arrangements with their participating clinics. This put on hold all access to the data by the non-OCHIN staff. The data agreements were subsequently executed and the project team was able to view patient data and begin the key tasks of chart review and quality measure implementation.

All data necessary for applying the measurement process has been staged. Primary care encounter data was drawn for the resultant population for the observation period beginning in January 2007 in KPNW (yielding roughly 125,000 eligible patients), and OCHIN (yielding roughly 25,000 eligible patients).

Initially, the team planned a 24-month evaluation period because they interpreted the NHLBI guideline to mean that BMI and waist circumference were to be documented every 2 years. They have re-interpreted the guideline to mean that BMI should be assessed at all primary care visits for all patients, and waist circumference at all primary care visits for obese and overweight patients. This change in the method reduced the need for evaluation from a 24- to a 1-month window.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track in some respects but not others and project funds are significantly underspent due to the previously described delay of data-sharing agreements with participating clinics. The project is using a 1-year no-cost extension to complete the project.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Chronic Care*, Obesity

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

MyMediHealth: A Paradigm for Children-Centered Medication Management

Principal Investigator:	Johnson, Kevin B., M.D., M.S.
Organization:	Vanderbilt University
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018168
Project Period:	December 2009 – November 2012
AHRQ Funding Amount:	\$1,200,000

Summary: Medication management of children with chronic conditions is complex because of the need to tailor dosages based on a child's age and development, and because of the likelihood that such children have multiple caregivers. To improve care of children with chronic disease, a team at Vanderbilt University Medical Center in Tennessee, led by Dr. Kevin Johnson, is working to address medication management in the pediatric population through further development of MyMediHealth, a mobile personal health application for medication management that is built to interface and share information with a personal health record (PHR). The overarching goal of this project is to investigate ways in which PHRs and supported applications can improve the safety and quality of medication delivery.

The study is evaluating the impact of the MyMediHealth application on medication adherence in children ages 12-to-18 who have asthma and are patients at the Vanderbilt Primary Care Clinic. The control group is receiving education on asthma management, while the intervention group is receiving education and training about asthma management and the use of MyMediHealth. The application provides medication information and reminders to children by cell phone. Patients are able to create medication schedules, schedule alerts to mobile devices, and examine medication administration information. The PHR provides laboratory results, relevant medical literature, email for direct communication with providers, and direct appointment scheduling.

The project team developed a knowledge base of common pediatric asthma medications that have been incorporated into MyMediHealth and will be part of the evaluation of the application on medication adherence. In addition to medication adherence, study measures include effect on family dynamics, disease control, and impact on caregivers outside the home, such as school caregivers and health care providers. The results of this study will have important implications for understanding how to further patient-centered care and medication adherence in the pediatric population. Some findings may also be applicable to chronic disease management in the adult population.

Specific Aims:

- Develop an information and scheduling knowledge base for common pediatric asthma medications (including allergy medications). **(Achieved)**
- Adapt MyMediHealth in its current prototype form to patients diagnosed with asthma. **(Achieved)**
- Integrate MyMediHealth into the Vanderbilt patient portal to support medication scheduling and the creation of medication reminders. **(Retired)**

- Evaluate the impact of MyMediHealth on medication adherence. **(Ongoing)**

2011 Activities: Due to security concerns from the risk management team at the University, Dr. Johnson was unable to have MyMediHealth integrated into Vanderbilt’s PHR, “My Health at Vanderbilt”. The risk management team felt that further research is needed to understand and protect patient data before the interface between these tools can be made available. As a result, the project team has developed MyMediHealth with the ability to interface with any PHR and thus it is not tailored to work specifically with My Health at Vanderbilt.

The project team completed the adaptations and modifications to MyMediHealth and plans to begin the evaluation in January 2012. In the last quarter of 2011, the project team developed and finalized the evaluation tools. The team has developed all of their measures for the evaluation and will be submitting the final protocol to their institutional review board.

All patient enrollment will be done by phone. The enrollment tools are currently being pilot tested. The evaluation will begin with the English-speaking patients; thereafter the team will begin translating the tools to Spanish. The MyMediHealth Web site has been undergoing testing using a “think aloud methodology” with community engagement groups established on the Vanderbilt campus. The Web site is where families will enter information on the child’s asthma dosing regimen, and it includes a place to input the child’s asthma action plan. The families can also use the Web site for data tracking after they have begun using the application.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and project spending is on target.

Preliminary Impact and Findings: An important finding of the project is how people use reminders. The project team initially planned to pilot the medication reminders for 9 months, but have obtained a good understanding of usage of the reminder system in a much shorter period of time (2 weeks).

A second finding is that there is quite a bit of cost associated with bi-directional texting to confirm compliance with medications. This is especially true if a patient is taking four-to-five medications. Some of the study participants have unlimited texting plans, and others do not. Despite the potential cost, the project team decided not to make unlimited texting a requirement for inclusion in the evaluation.

Target Population: Asthma, Chronic Care*, Medicaid, Pediatric*, Teenagers

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

** This target population is one of AHRQ’s priority populations.*

Data Flow & Clinical Outcomes in a Perinatal Continuum of Care System

Principal Investigator:	Levick, Donald, M.D., M.B.A.
Organization:	Lehigh Valley Hospital
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018649
Project Period:	September 2011 – September 2014
AHRQ Funding Amount:	\$335,705

Summary: Medical errors are often caused by poor communication, especially during transitions of care between the inpatient and outpatient care settings. For example, test results and clinical notes completed in one setting are often not available in the other, or discharge information and planned followup care are not communicated well between inpatient and outpatient providers. These issues are particularly striking for Obstetrician Gynecologists (OB/GYNs) who care for patients in both settings and frequently need all current clinical patient data. One solution to this problem is to integrate electronic medical record (EMR) systems in outpatient and inpatient settings to enable data exchange between systems and allow for patient data to be available in real time, regardless of the location of the provider or patient. Few EMR vendors can supply a single solution with a unified database of clinical information for the outpatient OB/GYNs and the inpatient Labor and Delivery (L&D) triage environments. Therefore, most organizations utilize separate clinical information systems.

To improve data access and completeness at all points in the perinatal continuum of care process, the Lehigh Valley Health Network (LVHN) implemented a vendor-supplied integrated ambulatory EMR system at its three outpatient OB/GYN practice groups. Additionally, a perinatal information system was implemented at the L&D unit at the network's main hospital, Lehigh Valley Hospital-Cedar Crest. The goal is to establish a real-time exchange of patient data between these systems, bridging the outpatient and inpatient settings. In theory, patient medical information from all physician offices participating in the integrated EMR system should be immediately available when a patient arrives at the L&D unit, and information from a patient's visits to the L&D unit should be available in the ambulatory care settings.

This study is evaluating the implementation of the integrated EMR system. Quantitative and qualitative data collected during the system implementation process is being used to assess the system's effect on organizational and process change in the outpatient and inpatient settings, and the system's ability to deliver accurate, complete, and timely data to providers and clinical staff at points along the perinatal continuum of care. Qualitative data is being collected by administering surveys, conducting interviews, and analyzing notes from meetings that occurred before, during, and after system implementation. The qualitative data will be used to describe the changes in organizational and workflow processes resulting from the integrated system. Quantitative data is being collected from surveys, LVHN databases, and the Pennsylvania Health Care Cost and Containment Council to assess the system on data completeness, medical outcomes, provider efficiency, and patient and provider satisfaction.

This project will map the quantitative and qualitative links between health information technology

(IT) adoption and individual patient outcomes (maternal and newborn), as well as patient and provider satisfaction. The evaluation should provide replicable lessons for other organizations attempting to integrate outpatient and inpatient data through health IT. It will also provide policymakers with an overall assessment of the costs and benefits of integrating EMR systems.

Specific Aims:

- Develop grounded theory to describe the process of effective implementation and integration of ambulatory EMR systems with hospital information systems through qualitative analysis of technology acceptance and use and complementary organizational and process change. **(Ongoing)**
- Examine quantitatively the change in data completeness (complete and accessible data) at the hospital and the individual practices resulting from the adoption of the integrated EMR system. **(Ongoing)**
- Examine quantitatively improvements in health outcomes, staff perceptions of patient safety, and patient and medical staff satisfaction, as well as changes in the productivity of primary care and inpatient physicians. **(Ongoing)**
- Using mixed methods, triangulate the results of the quantitative and qualitative analyses to gain a deeper understanding of how to achieve benefits from an integrated EMR. **(Upcoming)**

2011 Activities: Data collection is in process. Stakeholder interviews and document analyses are being conducted. Two rounds of surveys have been administered to staff in the inpatient and outpatient settings to assess the availability of data. Another round of surveys will be administered later in 2012.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track, and the project budget funds are somewhat underspent due to personnel costs coming in lower than projected at the time of reporting.

Preliminary Impact and Findings: TThis project has no findings to date.

Target Population: Women*: Pregnancy

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Facilitators and Barriers to Adoption of a Successful Urban Telemedicine Model

Principal Investigator:	McConnochie, Kenneth, M.D., M.P.H.
Organization:	University of Rochester
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018912
Project Period:	September 2010 – August 2013
AHRQ Funding Amount:	\$418,029

Summary: Since its inception in 2001, the Health-e-Access telemedicine network (HeA) in Rochester, NY, has been used to manage acute childhood illness. Three telemedicine service models have evolved from HeA's ability to bring care directly to children, instead of children traveling to their care provider. The three models focus on child, school, and after-hours neighborhood care. These models give families in Rochester several options for care of children with acute illnesses. Dr. McConnochie and his research team hypothesized that families will embrace the use of telemedicine via these new service models once they recognize their advantages over traditional care models, such as the use of emergency department care.

The goal of this project is for HeA to replace inconvenient, inefficient, and expensive traditional models of care with convenient, high-quality, and less-expensive models. The project is deploying and solidifying sustainable business models for each of the three telemedicine service models in four inner-city zip code areas in Rochester. Additionally, the project is identifying facilitators and barriers of implementation, monitoring the impact on utilization patterns, and creating and disseminating an implementation and sustainability toolkit. The research team is using both qualitative and quantitative methods of research, including unstructured key informant interviews, semi-structured interviews, and statistical analysis of utilization patterns. Identification of facilitators and barriers to replication of an existing telemedicine model may promote widespread replication in other communities and for a broader range of patients.

Specific Aims:

- Achieve substantial deployment and solidify sustainable business models for each of the three urban telemedicine service models. **(Ongoing)**
- Identify facilitators and barriers to dissemination of the three telemedicine service models. **(Ongoing)**
- Monitor impact of the HeA models on utilization patterns. **(Ongoing)**
- Create and disseminate an implementation and sustainability toolkit. **(Ongoing)**

2011 Activities: A number of methods were used to identify and assess barriers and facilitators of telemedicine implementation. Key informant interviews were conducted with parents, nurses who manage parent phone calls, telemedicine assistants who enable visits, providers, site staff, and leadership from various collaborating organizations. Focus groups were conducted with the parents of children who were eligible for telemedicine visits.

The research team developed and implemented a phone-based community illness survey to assess how families respond to the medical needs of a sick child. The goal is to complete 300 surveys; 200 were completed by the end of 2011. Survey recipients were obtained from a Rochester City School District list of 1,800 randomly sampled children eligible for telemedicine visits. Nearly half of these were unable to be reached due to intermittent cellular phone access, use of prepaid phone cards, or change in phone numbers. A new list of eligible children was requested from the school district.

Another focus of 2011 was the engagement of stakeholders of telemedicine. Continuing from 2010, Dr. McConnochie met with parent groups, physician organizations, insurance companies, and policymakers to promote the benefits of telemedicine. He is also collaborating with the Finger Lakes Health Systems Agency (FLHSA) to promote reimbursement for telemedicine visits. FLHSA has identified telemedicine as a strategy to reduce non-emergency visits to the emergency department and has been instrumental in drawing local insurers into the discussion of broader reimbursement for telemedicine, especially telemedicine infrastructure.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget funds are somewhat underspent due to conserving funds for upcoming cost-intensive activities.

Preliminary Impact and Findings: The preliminary information gathered from key informant interviews with nurses indicated that they believe telemedicine is valuable and would use it for their own children. Additionally, the researchers found that the call center tracks the rate of dropped calls (the number of times a caller hangs up while on hold), and noted an increase in the number of dropped calls. The interviews revealed that the process of explaining telemedicine requires significant time because most parents are not familiar with the concept. This causes lengthy on-hold times and lead to the high dropped call rate. In response, the team developed a script to help nurses explain telemedicine to parents more efficiently.

The focus group participants were urban mothers without telemedicine experience, the main demographic targeted for the study. Telemedicine was described as a more convenient way to get medical care for children because it does not require going to the doctor's office or waiting for an appointment. Among parents with telemedicine experience, satisfaction has been very high, and convenience has been a dominant theme among perceived benefits. Yet among mothers without telemedicine experience, most had a somewhat negative response to the "convenience" benefit. Focus group participants perceived the convenience of telemedicine as "cutting corners," and explained that "good mothers" do not cut corners; rather, they bring their children to the doctor's office. As a result, HeA now markets telemedicine as quality care that can reduce time spent in waiting rooms to allow more quality family time. The participants also expressed that a demonstration of telemedicine would greatly facilitate their understanding of the technology and that recommendations by their own providers would be a key determinant of their interest in using telemedicine for their children.

For the grant efforts, there were approximately 2,000 telemedicine visits in 2011, of which 55 percent of visits resulted in a prescription. This may be an early indication that telemedicine visits are serving a need in the community.

Target Population: Inner City*, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Online Counseling to Enable Lifestyle-Focused Obesity Treatment in Primary Care

Principal Investigator:	McTigue, Kathleen M., M.S., M.D., M.P.H.
Organization:	University of Pittsburgh
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018155
Project Period:	October 2009 – September 2012
AHRQ Funding Amount:	\$1,199,824

Summary: Because obesity is a major cause of cardiovascular disease, the United States Preventive Services Task Force (USPSTF) recommends that clinicians screen all adult patients for obesity and offer intensive counseling and behavioral interventions to promote sustained weight loss for those who are obese.

This study is looking at using health information technology to enable clinical lifestyle counseling on weight loss with the goal of integrating lifestyle issues into routine preventive medicine. The research is examining the effectiveness of delivering an online version of the Diabetes Prevention Program (DPP) lifestyle intervention in a primary care setting. Recruitment targeted a group of participants who vary in terms of gender, body mass index, comorbidity status, race, and ethnicity. The coaching strategies incorporate physician feedback. Assessment of the intervention looks at multiple outcomes, including change in weight, waist circumference, physical activity, quality of life, and intervention cost-effectiveness.

This research seeks to address the key problem of how to implement USPSTF obesity screening and treatment recommendations in a cost-effective manner and help translate well-established methods into a clinical setting. Furthermore, the use of technology may provide a more patient-centered approach to clinical obesity management.

Specific Aims:

- Use Internet technology to translate an evidence-based lifestyle intervention into diverse primary care settings in order to facilitate the delivery of evidence-based preventive counseling. **(Ongoing)**
- Examine how different strategies of delivering a DPP-based online lifestyle intervention differ in weight loss and cost-effectiveness. **(Ongoing)**

2011 Activities: The focus of activity was on the lifestyle coaches' 6- and 12-month face-to-face "outcome visits" with study participants. By December, all 12-month follow-up visits were completed. Throughout the year the project team implemented several new strategies to help increase participant compliance in completing their visits. Strategies included increasing the financial incentive from \$25.00 to \$40.00 and adding more ways to engage with participants, such as sending greeting cards. The strategies resulted in greater participation in the 12-month visits compared to the 6-month visit completion rate. Preliminary data analysis began in 2011 and more in-depth analysis will continue into 2012.

The project team also continued to meet with the software vendor on a regular basis to resolve minor technical issues, identify potential software enhancements, and increase quality assurance mechanisms. One technical enhancement made this year was to grant remote access to one of the life coaches who moved out of state, which allowed the coach to stay on as part of the project team and preventing the need to hire any new staff.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and the project budget is moderately underspent. Spending began to increase once the project team became fully staffed and the project team anticipates that spending will be on track for the remainder of the project.

Preliminary Impact and Findings: There are no findings to report as data collection is still in progress. Informal feedback from physicians at the participating sites suggests there is interest in access to an online weight-maintenance intervention.

Target Population: Adults, Obesity

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Improving Post-Hospital Transitions and Ambulatory Care for Children with Asthma

Principal Investigator:	Nkoy, Flory, M.D., M.S., M.P.H.
Organization:	University of Utah
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018678
Project Period:	April 2011 - March 2014
AHRQ Funding Amount:	\$1,191,501

Summary: Asthma is the most common chronic illness in children and can have a significant impact on quality of life for both children and their families. Asthma is also the most frequent reason for preventable hospital and emergency department (ED) admissions among children in the United States. Children hospitalized for asthma are at increased risk for readmission for several reasons, including; 1) hospital provider's non-compliance with evidence-based asthma preventive measures at patient discharge; 2) poorly-managed care transitions from the hospital to the ambulatory setting; 3) failure of primary care providers (PCPs) to monitor and manage chronic asthma; 4) patient non-compliance with asthma home therapy; and 5) failure to establish ongoing monitoring of asthma chronic symptoms in the ambulatory setting. Preventing asthma-related hospitalization and ED use can improve quality of life and reduce health care-related costs among children with chronic asthma.

This project is developing and evaluating two applications of health information technology (IT) intended to improve care transitions from the hospital to the ambulatory and home settings for children with asthma. The first application, an asthma-specific Reminder and Decision Support (RADS) system, has been developed and implemented to help hospital providers accomplish the following at discharge: 1) comply with evidence-based asthma preventive measures; 2) determine the patient's chronic asthma severity level; 3) determine severity-appropriate asthma preventive medications; and 4) establish effective care transitions to PCPs in the ambulatory setting. The second application, a Web-based Asthma Home Monitoring System (AHMS), also called the electronic Asthma Symptom Tracking and Exacerbation Reduction (e-ASTER), is being finalized to enable care continuity through continuous at-home self-assessment of patients' chronic asthma control, and support of PCPs in monitoring and managing chronic asthma symptoms.

The RADS system was built from an existing electronic discharge order and discharge instruction (DOADI) tool. The DOADI is currently used throughout Primary Children's Medical Center (PCMC) in Salt Lake City, Utah, by health care providers for all patients discharged with a medical diagnosis. The DOADI automatically transfers discharge information to PCPs in an accurate and timely manner. The RADS system was designed to automate the multiple functions of the paper-based discharge process. It uses the DOADI as a platform and automatically faxes asthma discharge information to the patient's identified PCP, including the patient's asthma action plan and preventive medications recommended by the hospital provider based on asthma guidelines.

The e-ASTER application was designed to: 1) engage patients in self-monitoring and self-management

of chronic asthma control by prompting compliance with therapy and appropriate and timely physician visits and; 2) support physicians with longitudinal data to assess the effectiveness of asthma therapy and prompt adjustments. The application includes an active real-time feedback and alerting system for patients and their parents to prompt early response to deteriorations in asthma control status. For patients without Internet access, an interactive voice response system will be used. These patients will receive real-time feedback upon entering information on their level of asthma control over the phone.

The e-ASTER application has been developed, programmed, and pilot-tested. Children admitted to PCMC for asthma between the ages of 2 and 18 will be invited to participate in a study to evaluate the utility of e-ASTER for ongoing asthma self-monitoring and self-management. Surveys will be administered to hospital providers who care for children admitted to PCMC during the project period, PCPs whose patients are enrolled in the study, and patients enrolled in the study and their caregivers to evaluate the attitudes, acceptability, and use of the both the RADS and the e-ASTER applications. Qualitative questionnaires and quantitative data (e.g., Web page views, log-in, and log-out times) will be used to determine factors associated with effective use of the health IT applications. Readmission rates within 6 months of the index hospitalization discharge will be determined for the overall study population and compared to results after implementation of the two health IT applications using time series analysis.

These health IT applications and the study findings will promote effective care transitions and continuity post-hospital discharge, and will enhance the quality of care for children with asthma.

Specific Aims:

- Develop two IT applications to improve post-hospital care transitions and ambulatory care. **(Ongoing)**
- Evaluate the attitudes, acceptability, and use of the new IT applications. **(Ongoing)**
- Determine factors associated with effective use of new IT applications by hospital providers, PCPs, and patients. **(Upcoming)**
- Determine the effect of implementing new IT applications by measuring specific process measures at the hospital provider, PCP, and patient levels, and on readmissions. **(Upcoming)**

2011 Activities: Development of the RADS system was completed and all major components of the system have been implemented at PCMC. The RADS system is now being used as part of the standardized asthma discharge process, and is successfully auto-generating and auto-faxing the patient's action plan, discharge instruction, and discharge summary to the PCP.

The AHMS was developed in a paper-based version (Asthma Symptom Tracker [AST]) and a Web-based version (e-ASTER). The AST was pilot-tested and determined valid and reliable. Two iterative usability testing sessions were conducted for the e-ASTER application and changes are being made based on feedback received to finalize the application. Development of the patient interface of the e-ASTER application is complete, while the clinic (PCP office) interface is in progress. The research team anticipates launching e-ASTER by March 2012 upon completing the security test of the Web site server.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track. The project budget funds are somewhat underspent because the study team is not fully staffed and outstanding subcontract invoices have yet to be received and processed.

Preliminary Impact and Findings: The research team pilot-tested the paper-based version of the AHMS, and determined it to be valid and reliable for monitoring asthma control. A manuscript is being written to publish preliminary findings.

Target Population: Asthma, Chronic Care*, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

** This target population is one of AHRQ's priority populations.*

Bringing High-Performing Systems to Small Practices

Principal Investigator:	Parsons, Amanda, M.Sc., M.D.
Organization:	New York City Health/Mental Hygiene
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018275
Project Period:	December 2009 – November 2012
AHRQ Funding Amount:	\$1,199,853

Summary: To date, there is limited evidence on the ability of small community health care providers to improve quality of care through the use of electronic health records (EHRs), and limited data on the impact of financial incentives for quality improvement on small providers. Investments in health information technology (IT) are being made to improve quality of care and while there is evidence of improved quality in integrated delivery systems, such as the Kaiser Permanente system, there is less evidence of the effectiveness of health IT on patient outcomes in nonintegrated health systems.

This study provides information on the effects that supportive EHR implementation, clinical decision support (CDS) systems, and pay-for-quality improvements have on small community providers' cardiovascular health outcomes. The New York City Primary Care Information Project (PCIP) is comparing the implementation of EHRs at 60 small ambulatory primary care practices that are early adopters of EHRs and part of an integrated delivery system throughout New York City to 60 similar practices in the area that are late adopters of EHRs. The project targets EHR implementation throughout New York City and focuses on some of the poorest neighborhoods.

The study will evaluate the impact of an EHR implemented with the support from technical assistance and added tools, including integrated registry systems and CDS, on improvements in quality of care as compared to practices that do not have an EHR or the aforementioned support. The primary goal is to determine whether practices that have supportive EHR implementation provide higher-quality care and experience a rapid rate of improvement of their quality measures. A secondary goal is to determine what characteristics, if any, indicate that supported EHR practices are atypical or have any consistently different characteristics as compared to other small independent practices. At a more nuanced level, the research will assess the attributable impact of various interventions on changes in four cardiovascular health outcomes at small practices that provide adult primary care. This will provide specific information on the value of various types of support on the rate of improvement on cardiovascular quality measures.

Specific Aims:

- Determine whether practices that participated in the PCIP program experienced a more rapid rate of improvement on their quality measures than practices that did not participate. **(Ongoing)**
- Determine if PCIP-participating practices are atypical in comparison to other small independent practices in New York City. **(Ongoing)**
- Assess the attributable impact of each intervention: adoption of EHR, CDS, and pilot pay-for-quality program. **(Upcoming)**

2011 Activities: The project team began to analyze the data for examining the effect of each successive stage of health IT implementation on higher-quality performance. This included analysis of a baseline survey describing providers' experiences with quality measurement, reporting, and incentives, as well as a survey of general provider characteristics. The project team continued analysis of baseline survey data that provides information on the characteristics of the practices that are early versus late adopters. EHR adoption among small clinics in New York has moved rapidly since the writing of the grant application, and there are fewer practices that have not begun EHR implementation. As a result, the project shifted the definition of the control practices from non-EHR adopters to a subset of practices that are late adopters of the EHR. For the later adopters, 58 practices representing a total of 134 providers were recruited. Similar to the early adopters, the majority of practices that were recruited as the late adoption group are solo or two-provider practices. The project defines 'early adopters' as those that adopted an EHR prior to January 2009. 'Late adopters' are those that adopted between January 2009 and March 2010.

At 6 months into the implementation of their EHR, each practice was asked to complete a followup survey to provide contextual information on the components of the EHR they were using, and their thoughts on Meaningful Use and other topics. Through the review of clinical outcomes data, the project team is beginning to measure the impact of each successive stage of IT integration. Clinical data are being gathered through chart review and where applicable, electronically. The team developed a form, database, and instruction set to collect the clinical data elements from paper charts that can be used to calculate the same quality measures as those calculated through the EHR. The other metric under review is the relationship between IT implementation and medical-home certification from the National Committee for Quality Assurance.

As last self-reported in the AHRQ Research Reporting System, project progress is mostly on track and the project budget funds are somewhat underspent due to delays in contracting.

Preliminary Impact and Findings: Preliminary analysis was conducted with the early cohort of practices to understand trends in quality measurement before and after EHR adoption, as well as 6-months after use of EHR. Within a cohort of 36 practices, 3,120 patient records were manually reviewed in two time periods prior to EHR adoption, a few months after EHR adoption, and 6-months after EHR adoption. Trends were calculated for the following quality-of-care measures: antiplatelet therapy; blood pressure control; cholesterol screening and control; hemoglobin A1c screening and control; smoking status recorded; smoking cessation intervention; and body mass index. Performance generally remained flat for most of the measures while using paper-based health records. For seven of the nine measures, the observed performance declined slightly after EHR adoption and then rebounded to pre-EHR levels or increased to higher rates after 6 months. The research team hypothesizes that the rebound may be a result of office staff and providers becoming more accustomed to the EHR systems.

Provider surveys have identified that while practices may have electronic tools, they may not realize that they need assistance to learn to use them. One specific tool that practices have struggled to use is referral tracking. The project team has published a manuscript in the *Journal of the American Medical Informatics Association* on the reliability of EHR-derived quality data: "[Validity Of EHR Derived Quality Measurement For Performance Monitoring.](#)"

Target Population: Adults, Inner City*, Medicaid, Medically Underserved, Safety Net

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Trial of the CarePartner Program for Improving the Quality of Transition Support

Principal Investigator:	Piette, John D., Ph.D., M.S.
Organization:	University of Michigan at Ann Arbor
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 019625
Project Period:	September 2011 - June 2014
AHRQ Funding Amount:	\$364,667

Summary: Patients hospitalized with complex chronic conditions frequently experience preventable short-term readmissions due to a lack of coordinated care and inadequate support when they transition from the hospital to the home setting. Proactive, post-discharge followup by continual patient monitoring and ensuring that patients have caregiver support to assist with managing their health and illness can reduce patients' re-hospitalization risk and improve the quality of care when transitioning from the hospital to home.

This study will evaluate the CarePartner (CP) intervention intended to improve the effectiveness of support for transitions from hospital to home for patients with common chronic conditions. The CP intervention uses low-cost health information technology (IT) and coordinated communication among patients' informal caregivers or CPs and their clinical teams to address their needs and manage their health. Patients in the CP intervention will receive comprehensive discharge planning for managing their chronic condition and coordinating their care across transitions. They will also receive direct, tailored monitoring and communication on self-care education via regular automated telephone calls post-discharge.

A randomized controlled trial of 380 patients will compare those with common chronic conditions receiving usual discharge planning and post-discharge support to outcomes among patients receiving the CP intervention. Patients will be recruited from the University of Michigan Health Center General Medicine Inpatient Service and will be asked to identify up to three CPs. CP intervention patients will receive automated assessment and behavior change calls, and their CPs will receive structured feedback and advice following each assessment. Patients' clinical teams will have access to patients' assessment results via the Web, will receive automated reports about urgent health problems, and will be able to communicate with patients and CPs using a secure Web page and a specially-designed voicemail service. Patients will complete surveys at baseline, 30-days, and 90-days post-discharge to assess measures such as health service use, health-related quality of life, self-care behaviors, and understanding of the transition process. CPs will complete surveys at baseline and 90-days post-discharge to evaluate factors such as CP burden and satisfaction with the intervention. Data on inpatient and outpatient clinic visits will be abstracted from patient medical records to assess utilization, readmission, and mortality outcomes. The primary outcome of the trial will be 30-day readmission rates. Secondary outcomes include functional status, self-care, and mortality risk.

The CP intervention targets multiple stakeholders and implements innovative IT approaches to promote successful care transitions by improving the effectiveness of patients' caregiving network, clinician followup, and patients' self-management of their health. This coordinated approach has strong potential to improve the quality of care and success of care transitions among patients with common chronic conditions.

Specific Aims:

- Determine whether the CP model for supporting effective transitions from hospital to home improves outcomes of care, including lower readmission rates, emergency department visits, and improved patient functional status. **(Upcoming)**
- Evaluate the impact of the intervention on process measures of transition quality and patients' medication-related self-management. **(Upcoming)**
- Determine whether the intervention increases the quality of life and quantity of support for patients' self-care using a mixed-methods approach to identify whether service reduces caregivers' stress and increases their disease-specific communication with the patient. **(Upcoming)**

2011 Activities: The project is in the development phase. Activities thus far have involved hiring essential staff for project startup, receiving institutional review board approval, developing the interactive voice response (IVR) system for the CP intervention, and training project staff to use the IVR system.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track and the project budget funds are somewhat underspent because not all project staff has been hired.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Self-Management & Reminders with Technology: SMART Appraisal of an Integrated Personal Health Record

Principal Investigator:	Roberts, Mark Stenius, M.P.P., M.D.
Organization:	University of Pittsburgh
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018167
Project Period:	October 2009 – September 2012
AHRQ Funding Amount:	\$1,183,337

Summary: The complexity of patients' medical conditions is increasing, making preventive care and disease management more difficult. There is growing interest in integrating personal health records (PHRs) with providers' electronic medical records (EMRs) to assist patient self-management and improve care for complex diseases. However, few studies currently evaluate the impact of PHRs on care outcomes.

This project is seeking to improve health care outcomes in patients who have or are at high risk for developing cardiovascular disease (CVD) by promoting patient self-management at more than 80 primary care practices, both small and large. Major activities include development of a patient-specific, active and interactive component to an existing electronic PHR; a randomized controlled trial to determine the effectiveness of passive and active PHR systems for improving adherence and clinical outcomes; and cataloging the facilitators and barriers to PHR implementation and use. The passive PHR used in this project allows patients to view portions of their EMR—including problem lists, medication lists, and test results—to communicate electronically with their physician's office and to track values of home-monitored blood pressure and glucose. This is the standard PHR form for many EMRs. The active PHR has the features of the passive PHR but also electronically advises patients to check a secure Web site when disease self-management tasks or preventive services are necessary. In this project, participants have been randomized to a passive PHR (n = 500) or an active PHR (n = 500) at four sites. Focus groups and surveys are being conducted among PHR participants, nurses, and physicians to determine the barriers to and facilitators of PHR use. Outcomes to be assessed include improvement in control of risk factors, frequency of compliance with testing guidelines, and clinical outcomes.

This project will help determine if the use of an active patient self-management version of an existing PHR can reduce cardiovascular risk factors.

Specific Aims:

- Develop a patient-specific, active and interactive component to an existing electronic PHR for patients with complex illnesses and conditions that contribute to the development of cardiovascular disease. **(Achieved)**
- Conduct a randomized controlled trial of the effectiveness of passive and active PHR systems for improving adherence and clinical outcomes of these patients in an ambulatory environment. **(Ongoing)**
- Enumerate and catalog the barriers and facilitators to implementation and use of an electronic PHR among providers and patients in an ambulatory setting. **(Ongoing)**

2011 Activities: The project team completed the development of the interactive component to the existing PHR in 2011. Email or text alerts are transmitted to the patients in the intervention group based on the specific cardiovascular health maintenance activities for which the patient is due. The project team is preparing a demonstration for the PHR user group that will include technical details on the management of the reminder system and data on the number of and intervals between reminders in a typical ambulatory patient population.

Recruitment to the randomized controlled trial was relatively slow in early 2011 and additional recruitment strategies, including direct mail, advertising, and a monthly raffle, were initiated to improve enrollment. Since the enrollment target of 1,200 study participants was achieved mid-year, the reminder mechanism has been successfully sending electronic reminders to study participants.

The study team has also completed several preliminary activities related to cataloging the barriers and facilitators to implementation, including conducting the first PHR user focus group.

Dr. Roberts did not submit a report with a status of activities or project spending to the AHRQ Research Reporting System in 2011.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Chronic Care*, Heart Disease

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

A Risk Based Approach to Improving Management of Chronic Kidney Disease

Principal Investigator:	Sequist, Thomas D., M.D., M.P.H.
Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018226
Project Period:	December 2009 – November 2012
AHRQ Funding Amount:	\$1,127,741

Summary: Chronic kidney disease (CKD), though common, is often unrecognized by primary care physicians. While better health outcomes can often be obtained with better disease identification and management, there has been limited review of the outcomes of comprehensive disease management of CKD and no studies of the impact of patient education on this condition. A research team at Harvard Vanguard Medical Associates, an integrated delivery system in Massachusetts, is conducting a randomized controlled study on the care of patients with stage 3 CKD in the primary care setting. The study implements a disease management program at 14 health centers with improved clinical decision support for physicians and self-management support for patients.

During the first phase of this project in 2010, one health center was selected to pilot test the clinical decision- and patient support materials. The randomized controlled trial is being conducted over 18 months and will include approximately 170 providers. The physicians in the intervention group will receive patient-specific alerts at the time of office visits, while the control group physicians will not.

The impact of combining electronic alerts, a disease registry, and a patient-education program on adherence to best treatment practices will be measured by several indicators, including problem lists and encounter codes. Assessment of the appropriate documented problem list and encounter codes will be used to measure primary care physician awareness of CKD. Providers will also be queried on how the use of the intervention tools affected their attitude about CKD management and the use of electronic reminder systems. Data for the study will be taken for patients with CKD from the electronic records in Harvard Vanguard's 2007 EpicCare electronic health record (EHR). The data will provide information on best practices in the treatment of CKD in the primary care setting through the use of EHRs, advanced decision support, and patient outreach and education.

Specific Aims:

- Use computerized clinical information systems to identify baseline predictors of appropriate evaluation and treatment of stages 3 and 4 chronic kidney disease, including patient characteristics and nephrology involvement. **(Achieved)**
- Assess whether quality of care for stage 3 chronic kidney disease can be substantially improved over 18 months by: 1) point-of-care electronic alerts to primary care physicians recommending risk-appropriate care; and 2) quarterly mailings to patients providing self-management support materials, including tailored recommendations based on personalized data from an electronic disease registry. **(Ongoing)**

- Assess the relationship between utilization of the intervention components and primary care physician attitudes towards both chronic kidney disease management and electronic reminder systems. **(Upcoming)**

2011 Activities: The 18-month randomized trial started in spring 2011. The intervention included physician alerts recommending risk-appropriate care and the mailing of patient support materials for those with CKD. In April and each following month, two clinical practice sites were initiated into the trial until all 14 sites were included. The phased initiation of sites addressed the potentially overwhelming number of nephrology referrals generated by the clinical decision support component of the intervention. During the pilot, the clinical decision support generated an increased number of nephrology referrals and the research team worked with nephrology department to ensure there was adequate capacity. A patient survey was completed and initiated with the start of the randomized trial to assess the quality of mailed patient self-support tools for chronic kidney disease and the quality of provider counseling on disease management. As last self-reported in the AHRQ Research Reporting System, project progress is mostly on track. The project budget funds to date are somewhat underspent due to delayed timing of patient mailings.

Preliminary Impact and Findings: In the first phase of research, the project team analyzed the predictors of quality of CKD care. The analysis found that among 11,760 patients treated by 166 primary care providers (PCPs) across 15 clinics, 66 percent had hypertension and 29 percent had diabetes. PCP awareness of CKD was low, at 24 percent, and only 10 percent of patients were co-managed with nephrologists. Most patients were not receiving appropriate CKD care, and both PCP awareness and nephrology co-management were consistently associated with improved effectiveness and drug safety.

The completed pilot intervention provided several insights into implementing the larger scale intervention. These included: 1) the volume of nephrology referrals generated through electronic alerts; 2) the patient reactions to educational mailing materials; and 3) the provider reactions to the electronic alerts.

Target Population: Chronic Care*, Kidney Disease

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Virtual Continuity and its Impact on Complex Hospitalized Patients' Care

Principal Investigator:	Smith, Kenneth J., M.D., M.S.
Organization:	University of Pittsburgh
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018151
Project Period:	October 2009 – September 2012
AHRQ Funding Amount:	\$1,193,052

Summary: Hospital care processes have changed dramatically over the last 10-to-15 years. Previously, hospitalized patients were cared for by their primary care physician (PCP), facilitating continuity of care between inpatient and ambulatory care settings. Currently, many hospitalized patients are cared for by hospital staff physicians and returned to their PCPs' care upon discharge. Without dedicated information transfer processes, this stratification of care can lead to information loss and medical error. Heightened communication with and involvement by the PCP in the care of hospitalized patients should decrease medication, diagnostic, and followup errors, thereby improving medical care quality and safety as well as patient and physician satisfaction.

This project enhanced MedTrak, the University of Pittsburgh Medical Center's electronic physician communication tool, with an intervention called Virtual Continuity. Virtual Continuity allowed PCPs to follow their hospitalized patients electronically and participate more directly in their care through the use of e-mails that are triggered by clinical events with embedded links to electronic medical record (EMR) data and communication portals, medication lists electronically delivered at admission and discharge, and immediate notification of discharge with pertinent clinical details.

To evaluate the impact of Virtual Continuity, a pre-post study will compare the frequency of discharge medication errors before and after initiation of the Virtual Continuity intervention. Additional evaluation measures include PCPs' frequency and timeliness of receiving information, PCPs' perception of information exchange adequacy and usefulness, patients' satisfaction with care and the information they receive, rates of rehospitalization, post-discharge emergency department visits, and PCP followup visits. The information technology cost of implementing and maintaining the Virtual Continuity intervention will also be assessed.

Specific Aims:

- Augment the present system of PCP notification through the development and use of electronic EMR links to allow Virtual Continuity for the PCP. **(Achieved)**
- Measure differences in patient care safety and quality between PCPs receiving Virtual Continuity versus usual communication in a pre-post study. **(Ongoing)**
- Evaluate the impact of Virtual Continuity. **(Retired)**

2011 Activities: The research team conducted a Delphi PCP survey via a Web-based interface. Data collection and analysis on the pre- and post-intervention period represented the majority of project work. Previous changes in study design, where the project is now collecting pre-intervention data via the EMR, have made it infeasible to collect survey data from this group, since informed consent, required for this data to be collected and linked to clinical data, cannot be obtained. In addition, the number of patients from whom they are able to obtain consent in the post-intervention phase continues to be well below their projections. The absence of pre-post data for comparisons and low numbers of surveys overall make evaluating the impact of Virtual Continuity difficult to achieve.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are somewhat on track and the project budget funds are somewhat underspent. The original plan to evaluate the impact of Virtual Continuity was to measure PCP and patient satisfaction pre- and post- intervention. Pre-intervention study data being collected by the EMR have made it infeasible to collect survey data from this group because informed consent is required for this data to be collected and linked to clinical data. In addition, the number of patients from whom they were able to obtain consent in the post-intervention phase was well below their projections. Therefore, this aim was retired because the absence of pre-post data for comparisons and low numbers of surveys overall made it unlikely that it could be achieved.

Preliminary Impact and Findings: The Delphi survey results were completed. Rated items in the first round with a 95 percent confidence interval lower boundary of 4.0 or more were defined as accepted by the panel. Items with a 95 percent confidence interval upper boundary less than 3.0 were rejected. All other items were defined as indeterminate. In the second round of the survey, the panel was asked to reconsider those indeterminate data items, showing them their prior rating and the group mean for each item in an effort reach further consensus on those items.

In the first round of the Delphi survey, 37 of 89 items were accepted, one was rejected, and 51 were indeterminate. The second round survey considered these 51 indeterminate items and consensus to accept was reached for six more items.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Flu Alert: Influenza Vaccine Alerts for Providers in the Electronic Health Record

Principal Investigator:	Stockwell, Melissa S., M.D., M.P.H.
Organization:	Columbia University
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018158
Project Period:	August 2009 – July 2012
AHRQ Funding Amount:	\$1,198,851

Summary: The Advisory Committee on Immunization Practices recommends that all children age 6 months and older receive the influenza vaccine. Despite this recommendation, vaccine delivery rates are low, even when the vaccine is available. This project aimed to tailor, implement, and evaluate influenza vaccine alerts in an electronic health record (EHR) for pediatric providers serving minority low-income populations at four community health centers.

Each of the four study sites is affiliated with the New York-Presbyterian Hospital Ambulatory Care Network (ACN) and Columbia University and is located in a federally-designated Health Professional Shortage Area. All providers in the study are part of the same general pediatric group practice and receive uniform influenza vaccine-related provider education. In 2008, the practices had a volume of nearly 64,000 visits by approximately 22,000 children, the majority of whom were covered by Medicaid and were Latino. The Vaccine for Children Program provides most of the vaccines given at the practices.

In the first year of this project, Dr. Stockwell and her research team conducted focus groups, individual interviews, and surveys of health care providers, nurses, and parents to elicit information for customizing the content, format, and features of the electronic alerts (FluAlert). In the second year, the alerts were iteratively refined and piloted among beta users based on end-user feedback. In the third year, the alerts were pilot tested within the four study sites using a cluster cross-over design. Throughout the study, the research team tracked process indicators, such as user rates, and obtained feedback from clinical sites. At the end of the project, user satisfaction will be assessed using survey data. Costs will be measured by comparing alert costs with published vaccine effectiveness rates and determining the costs for influenza-associated hospitalizations, outpatient visits, and impact on parent productivity.

Specific Aims:

- Integrate tailored provider influenza vaccine alerts into the EHRs of urban pediatric community health centers. **(Achieved)**
- Evaluate the impact of tailored provider influenza alerts on pediatric influenza vaccine delivery rates. **(Ongoing)**
- Evaluate the impact of tailored provider influenza alerts on pediatric influenza coverage rates. **(Ongoing)**

2011 Activities: The FluAlert pilot study that began August 2010 was finished in the beginning of 2011. Data from the pilot study was collected and analyzed. Following pilot testing, the research team

gathered feedback from physicians and nurses to assess the functionality of FluAlert. Based on this feedback, the following system modifications were implemented: 1) every person who accessed the visit note received an alert, rather than only the individual who initiated the note; 2) print buttons were added to allow providers to print educational information about vaccination; 3) guidelines about egg allergies and thimerosal were updated; and 4) cosmetic changes were made to the graphic user interface.

The FluAlert cluster cross-over trial began in October 2011 and will continue until March 2012. Two clinics were randomly assigned to begin the study with the FluAlert activated and two clinics with it off. After 4 weeks, the activation status was reversed. The activation process will be switched twice so that each clinic will have two 4-week periods when FluAlert is active and two 4-week periods when it is off, not including holiday weeks. In this manner, the cluster cross-over design uses each clinic as its own control group. Vaccine delivery performance will be compared during periods when the FluAlert is active to periods when it is off.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and the project budget funds are slightly underspent to conserve funds to complete the trial and subsequent data analysis.

Preliminary Impact and Findings: Analysis of the transcripts from focus groups with physicians identified several barriers to influenza vaccine delivery, including clinic resource issues, problems with multiple sources of immunization information, and lack of time to complete the vaccination process. The physicians also identified ways to improve the computerized reminder, such as timing of presentation, ability to access multiple sources of immunization records, and facilitation of vaccine ordering and documentation. These [results](#) were published in the March-April 2011 volume of *Preventive Medicine*.

Focus groups were also held with parents to learn more about their experiences with the flu vaccine and their thoughts about how to improve communication with providers. Parents indicated the importance of hearing about both benefits and potential risks of the vaccine, especially when vaccine safety is a concern. Thematic analysis indicates that parents want to learn about their child's risk for influenza and the side effects, safety, effectiveness, and timing of the vaccine.

In the 10-week pilot period, FluAlert generated 1,949 alerts. Fifty-four percent of the time (n=1,048), the alert indicated that the child was in need of an influenza vaccine. For those 1,048 instances, the vaccine was ordered 29 percent of the time; declined 34 percent of the time; and deferred 37 percent of the time. In cases when the vaccine was declined, the reason for declining the vaccine was documented 93 percent of the time. Children had a 1.29-greater odds of being vaccinated for flu when FluAlert was turned on than when it was turned off (95 percent confidence interval: 1.13-1.48).

Target Population: Low SES/Low Income*, Medicaid, Pediatric*, Racial or Ethnic Minorities*: Latinos, Teenagers

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Utilizing Health Information Technology to Improve Health Care Quality

Principal Investigator:	Storch, Eric, Ph.D., M.S., M.Phil.
Organization:	University of South Florida
Mechanism:	PAR: HS08-270: Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)
Grant Number:	R18 HS 018665
Project Period:	September 2011 - September 2014
AHRQ Funding Amount:	\$1,186,782

Summary: Childhood anxiety disorders affect a significant percentage of youth and cause substantial distress and impairment. Cognitive-behavioral therapy (CBT) and selective serotonin reuptake inhibitor (SSRI) monotherapies are effective and comparable treatments of childhood-onset anxiety disorders. While CBT lacks the side effects of SSRI therapy, there are practical concerns of dissemination due to the limited availability of trained clinicians; limited treatment center/therapist locations; travel expenses; and immediate treatment costs. Accordingly, there has been a growing body of research on the practicality and efficacy of computerized cognitive-behavioral therapy (CCBT).

This project is evaluating the feasibility and preliminary efficacy of disseminating a CCBT protocol to community mental health centers. An efficacious CCBT protocol could contribute to public health efforts to address the mental health needs of a large number of children diagnosed with anxiety disorders.

The project consists of a two-phase trial that evaluates the feasibility of implementing a patient-centered intervention in community mental health centers, followed by an efficacy trial. In Phase I, an open trial of CCBT that focuses on feasibility issues of providing this intervention in community mental health centers will be completed. The CCBT protocol will be tested in 18 youth, age 7-13 years, to determine its acceptability and feasibility. Assessment and treatment delivery protocols will be refined; feedback will be obtained from patients, families, therapists, and organizational consultants; and barriers will be identified and addressed in preparation for the Phase II trial.

In Phase II, a randomized controlled trial will: 1) compare CCBT to treatment-as-usual (TAU) in order to evaluate the acute efficacy of CCBT relative to TAU in youth with clinically significant anxiety disorders; 2) determine whether CCBT results in greater short-term treatment efficacy relative to TAU after treatments are withdrawn; 3) examine whether CCBT results in improved global functioning and reduced child and parent anxiety symptoms relative to TAU; and 4) examine whether CCBT is associated with greater satisfaction and consumer acceptability than TAU.

While this study is being coordinated by a research team at the University of South Florida Rothman Center for Neuropsychiatry, recruitment will take place at three community mental health centers that serve families of lower socioeconomic status throughout Florida.

Specific Aims:

- Assess CCBT for clarity, completeness, and feasibility in a pilot study of 18 children ages 7-13 years, with significant involvement from caregivers. **(Ongoing)**

- Conduct a randomized controlled trial of 110 children to determine the efficacy of CCBT relative to TAU. **(Upcoming)**
- Examine factors that may predict CCBT outcome. **(Upcoming)**

2011 Activities: In its first quarter of its first year, the project focused upon start-up activities. During regularly scheduled phone meetings, Dr. Storch, University of South Florida research staff and investigators, and site coordinators and therapists discussed varying aspects of the research plan. The University of South Florida obtained site subcontracts for each performance site. These subcontracts outlined the scope of work required of each site to receive payment.

Changes to the protocol, informed consent, and related study forms were finalized, submitted to, and approved by the institutional review board (IRB). IRB study approval was obtained from the performance sites. The site therapists, coordinators, and study investigators completed IRB ethics and other required training.

A 2-day training for all study coordinators, therapists, research investigators, and consultants was organized at the University of South Florida. The training explained the procedures for implementing the protocol, both from a logistical (organization, participant tracking, safety monitoring, etc.) and application perspective (treatment and assessment protocols). Therapists were trained to implement the treatment protocol.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are completely on track and project budget spending is roughly on target.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: Chronic Care*, Mental Health/Depression, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Medication Reconciliation to Improve Quality of Transitional Care

Principal Investigator:	Weiner, Michael, M.D., M.P.H.
Organization:	Indiana University
Mechanism:	PAR: HS08-270: Utilizing Health IT to Improve Health Care Quality Grant (R18)
Grant Number:	R18 HS 018183
Project Period:	September 2009 – September 2012
AHRQ Funding Amount:	\$1,181,628

Summary: Medication errors account for approximately 20 percent of all medical errors in the United States each year. This significant source of error can cause injury or even fatalities and happens in all types of health care settings, including patient transitions between locations or care levels within a facility. Recent studies have shown that electronic medication reconciliation (MR) for hospitalized patients can decrease medication discrepancies and significantly improve outcomes in transitional and ambulatory care. Relatively little is known, however, about the extent to which MR systems improve clinical outcomes.

This study seeks to integrate an electronic MR system with an electronic prescribing (e-prescribing) system and modify an electronic health record (EHR) to incorporate medication reconciliation. The project is taking place within Wishard Health Services, a safety net provider for residents of Marion County, Indiana that includes Wishard Hospital and eight primary ambulatory care community health centers. This project has a technical and a clinical team, both of which Dr. Weiner is a member. The clinical team provides input and guidance for the technical team, which meets weekly to discuss and advance the system's development. Because the proposed system requires a formative evaluation, the initial system is being reviewed by a small group of physicians and nurses who are not part of the study teams.

The randomized study design allows for a controlled comparison of electronic MR and usual care. Participants include patients and their inpatient and ambulatory care providers. While the intervention is based in an emergency department and hospital, it targets transitional care and is meant to improve outcomes for both inpatient and ambulatory care. Providers are surveyed before and after the intervention about satisfaction with care, managing medications, and usefulness of local information systems in managing medications. Additional analysis will look at changes in the rates of adverse drug events, erroneous discrepancies, and omissions in a patient's medication list between the time of discharge and return to ambulatory care. Associations between interventions and outcomes will be summarized regarding factors related to payer, race, gender, and age. The study will inform the question of whether electronic facilitation of inpatient MR improves completion of MR and decreases the incidence of drug-related medical errors.

Specific Aims:

- Integrate an electronic medical reconciliation system with an e-prescribing system. **(Achieved)**
- Modify an EHR system to incorporate medication reconciliation. **(Achieved)**

- Conduct a randomized controlled trial of the medical reconciliation system. **(Ongoing)**
- Determine whether electronic facilitation alters medical reconciliation and the incidence of medication errors in ambulatory care. **(Ongoing)**

2011 Activities: In an effort to integrate the MR system with e-prescribing, the study team made several refinements to the user interfaces to increase the speed of the system, improve the dictionary of medications, and refine the text-based output. The team also continued to make efforts to increase accessibility of pre-admission medication lists and allow the system to integrate data collection from different pharmacies. Both of these goals were achieved.

To inform the intervention design, the project team implemented a brief survey in 2010 to ask physicians about satisfaction with local tools and resources for managing inpatient medications, ease of managing medications, and accuracy of medication lists as noted in medical records. More than 200 survey responses were received in 2011 and analysis of preliminary survey results was done. The project team is conducting focus-group discussions to gain additional detailed feedback about medication management and the project. Two of the focus groups have met and at least one additional group is planned for 2012.

Meanwhile, the clinical trial is underway, with more than 800 uses of the intervention system logged at the end of 2011, among approximately 5,000 admissions. Multiple training sessions have been conducted to introduce the study to intervention team members and evening float physicians. There has been a gradual increase in the use of the system. During the last quarter of 2011, the study staff shadowed four users for several hours and recorded observations and suggestions about how to improve the system.

As last self-reported in the AHRQ Research Reporting System, the progress of project activities is on track. The budgeted funds are significantly underspent, however with some of the more time-intensive activities underway in 2012, the project team anticipates that the rate of spending will increase.

Preliminary Impact and Findings: There are no project findings to date.

Target Population: Adults, Safety Net

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Bringing Communities and Technology Together for Healthy Aging

Principal Investigator:	Gustafson, David H., Ph.D.
Organization:	University of Wisconsin - Madison
Mechanism:	RFA: HS10-016: Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (P50)
Grant Number:	1P50 HS 019917
Project Period:	June 2011 - May 2016
AHRQ Funding Amount:	\$9,502,788

Summary: For many older adults, aging in place and living independently as long as possible are important goals. Assistive technology can extend the period of independent living and support older adults, as well as informal and formal caregivers, by providing information, skill building, and social support. Many technologies have been developed to assist aging in place, yet in general, adoption has been slow because technology is not designed for older adults.

The Active Aging Research Center (AARC), a consortium of partners from the University of Wisconsin-Madison, State government, and community-based organizations, is developing and implementing an integrated information and communication technology (ICT) system to facilitate and enhance aging in place. ICT consists of the hardware, software, networks, and media for collecting, storing, processing, transmitting, and presenting information. Working with community-based aging and disability resource centers (ADRCs) and the older adults and families they serve, AARC is implementing a 5-year strategy to develop, test, and disseminate a program of cost-effective integrated ICT addressing the top five reasons older adults in Wisconsin leave their homes: 1) loneliness and isolation; 2) falls; 3) relapse from proven falls-prevention strategies; 4) loss of driving privileges; and 5) unreliable home services.

The program involves several components conducted in overlapping phases, starting with community-based participatory research to collect information and data on the assets, issues, and needs of local communities and service providers, and to assess older adult and caregiver technology acceptance. Concurrently, AARC is adapting an existing ICT, the Comprehensive Health Enhancement Support System (CHESS), used to help individuals with chronic or life-threatening illnesses improve their quality of life through Web-based support or other kinds of technology. The adapted ICT, known as Elder-CHESS (E-CHESS), is a suite of electronic services intended to support older adults and their informal caregivers by facilitating aging in place and improving quality of life. E-CHESS is incorporating findings from community-based participatory research and is being designed to work across several interfaces, including mobile, tablet, laptop, desktop, and Web-enabled TV devices.

With E-CHESS as the platform, additional ICTs will be developed, including: a driving system to help older adults drive safely and retain independence longer; service dependability systems to support improvements in the dependability of services provided to older adults' home; and a falls-prevention system to sustain the benefits of an evidence-based falls-prevention program for older adults.

The research team will conduct a randomized trial to evaluate E-CHESS. Older adult-caregiver dyads will be randomized to receive E-CHESS for a 9-month period and followed for an additional 9 months,

or to a control group that will receive E-CHESS 9 months after being randomized. This 18-month trial will allow the research team to assess E-CHESS outcomes such as psychosocial benefits to older adults and caregivers, and cost-effectiveness regarding health care use. Lastly, E-CHESS and its related driving, falls prevention, and service dependability systems will be promoted and widely disseminated.

In addition to developing and evaluating E-CHESS and its integrated systems, AARC will fund additional pilot projects to support other research related to improving older adult independence.

Specific Aims:

- Assess the assets and needs of elders, caregivers, ADRCs, communities, and medical and social-service providers in urban, suburban, and rural counties in Wisconsin. **(Ongoing)**
- Adapt E-CHESS to facilitate aging in place by addressing the issues of: loneliness and isolation; falls; relapse from proven falls prevention strategies; loss of driving privileges, and unreliable home services that hinder or prevent older adults from living independently in their home. **(Ongoing)**
- Deliver E-CHESS across multiple platforms, with optimized interfaces for various mobile, tablet, laptop, desktop, and Web-enabled TV devices, thereby maximizing functionality across users. **(Ongoing)**
- Evaluate E-CHESS by testing the impact of E-CHESS on elder independence and quality of life as well as to determine the cost effectiveness of E-CHESS to reduce health care utilization. **(Upcoming)**
- Promote wide dissemination of E-CHESS and its related driving, falls prevention, and service dependability systems both locally and nationally. **(Upcoming)**

2011 Activities: The research team conducted environmental scans, focus groups, and key informant interviews to gather information about existing services, gaps in services, barriers to living independently, and the needs of older adults to inform the development of E-CHESS. The team focused on building and refining three components of the system thus far: 1) enhancing communication between older adults and family caregivers; 2) addressing older adults' perceptions of vulnerability; and 3) addressing medication management issues.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are mostly on track and project budget spending is roughly on target.

Preliminary Impact and Findings: To design E-CHESS to assist the caregivers of older adults with expanding their social network, the research team conducted interviews with caregivers such as a spouse or partner. These interviews revealed that the caregivers are not necessarily interested in expanding their social network because they worry they will be grouped with people they find boring or that participation in such a group will increase their burden rather than reduce it. Caregivers did express interest in easy-to-use technology to communicate with others.

Target Population: Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Table 12: Other Grants (Career, Dissertation, and Other)

AHRQ Small Grant Program for Conference Support (R13) and AHRQ Grant Program for Large Conference Support (R13) and (U13)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Agarwal, Ritu, PhD, MBA, MS	2011-2013 Workshop on Health IT and Economics (WHITE)	PAR09-257	295
Yes	Calmbach, Walter, MD	Primary Care Research Methods and Statistics Conference	PAR09-257	297
No	Reddy, Madhu, PhD, MS, MS	Workshop on Interactive Systems in Health Care 2011	PAR09-231	298
No	Schmaltz, Stephen, PhD, MS, MPH	Development of Risk-Adjusted Outcome Measures in the EHR Environment	PAR09-231	300
Special Emphasis Notice: AHRQ Announces Interest in Career Development (K01, K02, K08) and Dissertation (R36) Grants Focused on Health Information Technology (IT)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Armstrong, April, MD	Patient-Centered Online Care Model for Follow-Up Management of Atopic Dermatitis	HS08-014	302
No	Baer, Heather, ScD	Use of Electronic Health Records for Addressing Overweight and Obesity in Primary Care	HS08-014	304
Yes	Barrette, Eric, MA	The Impact of Health Information Technology on Demand for Inpatient Services	HS08-014	306
No	Del Fiol, Guilherme, MD, MS, PhD	Context-Aware Knowledge Delivery into Electronic Health Records	HS08-014	308
No	Gesteland, Per, MD, MS	Using Health Information Technology to Support Population-Based Clinical Practice	HS08-014	310
No	Graetz, Ilana, PhD candidate	EHR Use and Care Coordination	HS08-014	313
No	Hirsch, Annemarie, PhD candidate, MPH	Evaluating Electronic Health Record Data for Use in Diabetes Quality Reporting	HS08-014	315
No	Koopman, Richelle, MD, MSCR	Patient Readiness to Use Internet Health Resources	HS08-014	317
No	Lafleur, Joanne, PharmD, MSPH	Knowledge Engineering for Decision Support in Osteoporosis	HS08-014	319
No	Rand, Cynthia M., MS, MD, MPH	Using Health Information Technology to Improve Delivery of HPV Vaccine	HS08-014	321
Yes	Taha, Jessica Rose, MS	The Effects of Age, Cognition, and Health Literacy on use of a Patient Electronic Medical Records	HS08-014	323
No	Valdez, Rupa Sheth, MS	Creating a Foundation for the Design of Culturally-Informed Health IT	HS08-014	326
No	Wen, Kuang-Yi, PhD, MS	MyHealthPortal: Using an Electronic Portal to Empower Patients with Breast Cancer	HS08-014	328
No	Were, Martin, MD, MS	Improving Management of Test Results that Return After Hospital Discharge	HS08-014	330
Centers for Education and Research on Therapeutics (CERTs) (U18 and U19)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Bates, David, MD, MSc	Health Information Technology and Improving Medication Use	HS07-004	332

No	Bates, David, MSc, MD	Health Information Technology Center for Education and Research on Therapeutics	HS11-004	336
No	Lambert, Bruce, PhD, MA	Tools for Optimizing Medication Safety (TOP-MEDS)	HS11-004	338
AHRQ Health Services Research Projects (R01)				
Completed in 2011	Principal Investigator	Project Title	Funding Opportunity Announcement	Page of Summary
No	Alpern, Elizabeth, MD, MSCE	Improving the Quality of Pediatric Emergency Care Using an Electronic Medical Record Registry and Clinician Feedback	PA09-070	340
No	Carroll, Aaron, MD	Computer Automated Developmental Surveillance and Screening	PA09-070	342
No	Grannis, Shaun, MD, MS	Improving Population Health Through Enhanced Targeted Regional Decision Support	PA09-070	344

2011-2013 Workshop on Health IT and Economics

Principal Investigator:	Agarwal, Ritu, Ph.D., M.B.A., M.S.
Organization:	University of Maryland
Mechanism:	PAR: HS09-257: AHRQ Grant Program for Large Conference Support (R13) and (U13)
Grant Number:	R13 HS 021022
Project Period:	September 2011 - November 2013
AHRQ Funding Amount:	\$16,085

Summary: Health information technology (IT) research is being conducted in a variety of fields, including health services research, medical informatics, computer science, public health, business, and economics. Each field brings unique insights into health IT research, yet rarely do these fields collaborate. The annual [Workshop on Health IT and Economics](#) (WHITE) promotes interdisciplinary collaboration and communication in health IT research by providing a forum for knowledge creation, sharing, and dissemination. In addition to bringing together academic disciplines engaged in health IT research, the workshop includes health IT funders, policymakers, and practitioners to help promote dialogue between these stakeholders.

WHITE is held annually in October in Washington, D.C., and is hosted by the Center for Health Information and Decision Systems at the University of Maryland, College Park. The workshop is organized and led by a multi-disciplinary committee, including Principal Investigator Ritu Agarwal. WHITE is a 2-day program that includes two keynote speakers, two panel discussions, 30-40 oral presentations, and 20 poster presentations. A board of advisors, including members from both the research community (academic advisors) and the practice community (industry advisors), serves as a source of information and recommendations for health IT-related research issues. The board also advises the workshop organizers on program focus areas. Additionally, a program committee composed of approximately 40 researchers from more than 30 academic research institutions assists with reviewing paper and poster submissions for presentation at the workshop.

A formal evaluation process is used for obtaining feedback from participants about the workshop, and a satisfaction survey is administered to participants at the end of the workshop.

Specific Aims:

- Build the foundation for a multidisciplinary health IT research community by gathering researchers from medical informatics, computer science, public health, business, and economics. **(Achieved)**
- Provide a forum for leading researchers to disseminate cutting-edge findings and knowledge. **(Achieved)**
- Afford policymakers and practitioners the opportunity to shape the evolving health IT research agenda. **(Ongoing)**
- Develop the next generation of health IT researchers. **(Ongoing)**

2011 Activities: The second annual WHITE was held on October 21–22, 2011 at the Washington Marriott Hotel in Washington, D.C. Academy Health and Optimal Solutions Group co-sponsored the workshop. More than 90 participants representing 54 organizations attended. The workshop featured keynote speakers and panelists from government agencies such as the Agency for Research Healthcare and Quality, the Congressional Budget Office, the Office of the Secretary, and the Office of the National Coordinator for Health Information Technology; research institutes including the RAND Corporation, Johns Hopkins University, Carnegie Mellon University, Massachusetts Institute of Technology, and the Lewin Group; and practitioners from the U.S. Air Force and Miami Children’s Hospital. A wide variety of disciplines were represented at the workshop, and attendees demonstrated outstanding engagement that was sustained throughout the 2-day workshop.

Planning is ongoing and underway for the 2012 workshop.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: Not Applicable

Business Goal: Synthesis and Dissemination

Primary Care Research Methods and Statistics Conference

Principal Investigator:	Calmbach, Walter
Organization:	University of Texas Health Sciences Center
Mechanism:	PA: HS06-378: AHRQ Grant Program for Large Conference Support (R13) and (U13)
Grant Number:	R13 HS 017658
Project Period:	September 2008 – September 2011
AHRQ Funding Amount:	\$182,621

Summary: Economic constraints have limited the number of fellowship programs that train primary care researchers. This presents a gap in necessary mentoring and ongoing training of both fellowship- and non-fellowship-trained researchers. To address this need, this grant supported the Primary Care Research and Methods and Statistics Conferences, which are held to build research capacity of both novice and experienced researchers. For novice researchers, the conferences develop basic research skills, such as planning and conducting simple studies and communicating results. For experienced researchers, the conferences build understanding of research techniques and statistical approaches to conducting high-quality, sophisticated primary-care studies.

Primary Care Research and Methods and Statistics Conferences were held December 5-7, 2008; March 19-22, 2009; January 22-24, 2010; and December 2-4, 2011. The conferences included a pre-conference workshop for experienced researchers, plenary sessions, a dissection of innovative studies, and a methodological think-tank process workshop, and offered two theme-based seminar tracks. Conference attendees were asked to evaluate each speaker and the conference itself. Information about the conferences is disseminated to primary care researchers through professional society newsletters, email Listservs, Web sites, and professional annual meetings to promote attendance.

Specific Aims:

- Help novice researchers develop basic research skills. **(Achieved)**
- Help experienced researchers expand their repertoire of research methodologies. **(Achieved)**

2011 Activities: The 2011 conference, “Research with Vulnerable Populations,” was multidisciplinary and attracted a wide variety of researchers, including health services, family medicine, internists, and pediatricians. Presentations included “Conducting Research on Homeless Populations” and “A Practical Approach to Missing Data in Scale Construction and Analysis.” The presentations are available on the conference [Web site](#).

Impact and Findings: The project has no findings.

Target Population: General

Strategic Goal: Not Applicable

Business Goal: Synthesis and Dissemination

Workshop on Interactive Systems in Health Care 2011

Principal Investigator:	Reddy, Madhu, Ph.D., M.S., M.S.
Organization:	Pennsylvania State University
Mechanism:	PAR: HS09-231: Small Grant Program for Conference Support (R13)
Grant Number:	R13 HS 021058
Project Period:	October 2011 - September 2012
AHRQ Funding Amount:	\$40,500

Summary: A limiting factor to realizing the full potential of health information technology (IT) has been its low level of adoption and use. Research suggests that barriers to health IT adoption and use stem from a disconnect between the features or design of health IT and the needs of health care providers and patients. To better understand and support health care via IT and increase adoption and use, research initiatives are focusing on improving alignment of IT with user needs.

The Workshop on Interactive Systems in Healthcare 2011 (WISH 2011) was intended to enable interdisciplinary dialog on health IT and interactive systems in health care, and to provide a forum for sharing research, experiences, and perspectives that further enable progress in the design and development of health IT. WISH 2011 was held in conjunction with the American Medical Informatics Association (AMIA) Annual Symposium in Washington, D.C.

WISH is organized and led by co-chairs Drs. Madhu Reddy and Lena Mamykina. A multidisciplinary steering committee including members from the fields of biomedical informatics, public health, policy, and human-computer interaction helped the co-chairs plan the workshop. The steering committee identified and recruited potential speakers, assisted in choosing specific topic areas for presentations, and reviewed and selected submissions for presentation at the workshop. The format of the workshop included keynote speakers; panel discussions; technical presentations on topics such as design, methodology, evaluation, and technology; informal breakout sessions; and poster sessions. Additionally, the workshop included a mentorship program to pair promising junior researchers and students with prominent and experienced senior researchers in a related field.

WISH 2011 will be evaluated by administering online surveys to the workshop participants. Surveys will be sent out later in 2012 and will ask participants what they learned from the workshop, if they found the workshop to be of value, and whether they specifically attended the AMIA Annual Symposium in order to attend the workshop.

Specific Aims:

- Develop research agendas for interactive systems in health care and identify strategies and mechanisms for studying them. **(Achieved)**
- Discuss and develop consensus around research methodological and technical issues in regards to design and evaluation of interactive systems in health care. **(Achieved)**
- Establish a new channel for dissemination and implementation of research on interactive systems in health care. **(Achieved)**

- Provide a forum for developing new partnerships among researchers and stakeholder organizations thereby building their capacity to participate in research activities and using the results of research on interactive systems in health care. **(Achieved)**
- Establish a mentorship program for junior researchers in the field and provide them with the opportunity to meet with leading researchers in the areas related to interactive systems in health care. **(Achieved)**

2011 Activities: WISH 2011 was held on October 22 as a 1-day interdisciplinary research symposium in conjunction with the AMIA Annual Symposium. The workshop included keynote presentations, panel discussions, and technical presentations all intended to break down barriers of health IT design, implementation, adoption, and use. One-hundred and ten people from a variety of disciplines attended WISH. Based on the feedback, interest, and value noted in holding this workshop, planning is in progress for WISH to be held again in 2013.

Preliminary Impact and Findings: Four themes were consistently present during the proceedings of WISH 2011: 1) how to foster innovation in health IT; 2) the benefits and challenges of theory-driven health IT design; 3) the adoption and meaningful use of health IT; and 4) conducting interdisciplinary research in health IT. These four themes are described and expanded on in a publication, [Designing interactive systems in health care: A report on WISH 2011](#), authored by the co-chairs and organizer of WISH 2011 and published in *Interactions*.

Target Population: General

Strategic Goal: Not applicable

Business Goal: Synthesis and Dissemination

Development of Risk-Adjusted Outcome Measures in the EHR Environment

Principal Investigator:	Schmaltz, Stephen, Ph.D., M.S., M.P.H.
Organization:	Joint Commission
Mechanism:	PAR: HS09-231: Small Grant Program for Conference Support (R13)
Grant Number:	R13 HS 021051
Project Period:	October 2011 - September 2012
AHRQ Funding Amount:	\$49,699

Summary: One way to evaluate performance in health care is to examine health outcomes. Health outcome measures can indicate changes in health status. However, in order to accurately reflect the performance of a health care system or provider, outcome measures require risk adjustment for patient factors such as co-morbidities, severity of illness, and physiological status, to accurately compare performance across providers and over time.

The quality and usefulness of an outcome measure depends on the quality of its accompanying risk adjustment model. Widespread electronic health record (EHR) implementation promises to supply more and better data upon which to base outcome measures and construct risk adjustment models. Risk-adjusted outcome measures will be useful for quality improvement efforts, public reporting, pay-for-performance, oversight, and consumer decisionmaking.

For this project, the Joint Commission will hold an invitational conference to examine methodological issues related to the identification and development of outcome measures and their accompanying risk-adjustment models in the EHR environment. The conference will explore several questions, including: How can EHR data be used to develop risk models for existing mortality and readmission outcome measures? What new risk-adjusted outcome measures beyond mortality and readmission rates can be generated through EHR data? What are the challenges and barriers to using EHR data in the development of risk-adjusted outcome measures, and how can they be overcome?

This conference will be the first step in establishing valid risk-adjusted outcome measures developed using data from the EHR to better understand the effectiveness of health care services.

Specific Aims:

- Identify ways that the EHR can be used to develop new risk-adjusted outcome measures across health care settings. **(Upcoming)**
- Identify ways that the EHR can be used to enhance current risk models that have been developed for existing outcomes measures. **(Upcoming)**
- Use the results of the conference to form the basis of a demonstration project during which risk-adjusted outcome measures will be developed and tested using EHR data. **(Upcoming)**
- Widely disseminate the knowledge and information gathered from the conference through a white paper. **(Upcoming)**

2011 Activities: Planning is underway for the conference, which will be held on March 13-14, 2012 at the Joint Commission Headquarters in Oakbrook Terrace, Illinois. The 16 invited participants have confirmed their attendance. All participants are experts in outcome measures, EHR, or risk adjustment. Dr. Paul Schyve, Senior Advisor for Healthcare Improvement, will moderate the meeting, which includes a series of five presentations on: 1) outcome measures; 2) EHR technology; 3) EHR standards; 4) EHR implementation; and 5) risk adjustment. These presentations are intended to provide background and context to the discussion and brainstorming sessions scheduled for the later part of the conference, and to inform the attendees' development of a conceptual framework for EHR outcome measures and risk adjustment in the hospital setting.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: Not Applicable

Business Goal: Synthesis and Dissemination

Patient-Centered Online Care Model for Followup Management of Atopic Dermatitis

Principal Investigator:	Armstrong, April, M.D.
Organization:	University of California Davis
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 018341
Project Period:	November 2009 – November 2014
AHRQ Funding Amount:	\$713,340

Summary: Access to timely, high-quality dermatologic care poses a significant challenge in the United States. Store-and-forward teledermatology—defined as the practice of dermatology through digital capturing and storage of clinical images and information, followed by asynchronous review of the clinical information by a dermatologist—presents an opportunity to improve patient satisfaction and access to dermatological specialist care.

This project introduced a patient-centered, technology-enabled model for delivering followup dermatology care. Dermatologists from the University of California Davis Medical Center participate in an asynchronous, online model for delivering direct followup dermatology care to patients with atopic dermatitis, a chronic skin disease from which millions of Americans suffer. In this online model, patients communicate directly with their dermatologists, capture and transmit digital skin images, and receive online treatment recommendations and prescriptions via RelayHealth software.

This year-long randomized controlled trial (RCT) is looking at clinical outcomes, quality of life, patient satisfaction, and knowledge of dermatologic conditions in patients receiving conventional, face-to-face care versus those receiving care via the patient-centered care online model. This model has the potential to be adapted for patients suffering from other medical conditions that require regular followup visits to specialists.

In addition to the research project goals, Dr. Armstrong is furthering her long-term career goal of increasing access to specialist care for patients in rural and medically-underserved communities. Funding from this Mentored Clinical Scientist Research Career Development Award will allow Dr. Armstrong to advance her skills in health services research through structured coursework and regular seminars and mentoring with leaders in health services research, dermatology, and telemedicine.

Specific Aims:

- Assess the effect of this asynchronous, online model for delivering direct, followup dermatologic care on clinical outcomes in patients with atopic dermatitis. (Ongoing)
- Evaluate the effect of this asynchronous, online model for delivering direct, followup dermatologic care on quality of life in patients with atopic dermatitis. (Ongoing)
- Determine the level of patient satisfaction and patient knowledge about atopic dermatitis in the asynchronous, online model for delivering direct, followup dermatologic care. (Ongoing)

2011 Activities: Dr. Armstrong's primary work during 2011 was the RCT and the accompanying data collection. In September 2011, the trial was complete. All participants completed the year-long study, which included five dermatology visits, either online or in-office, at 8-week intervals. Attrition of patients was low in both arms of the study. Patients in both the intervention and the control groups completed multiple self-assessment tools, including the Patient-Oriented Eczema Measure to assess disease severity, and the Dermatology Life Quality Index or Children's Dermatology Life Quality Index, to assess dermatology-specific quality of life at each visit.

Dr. Armstrong began data quality-assurance activities, including ensuring that the data are coded correctly and other data cleaning activities, to prepare for analysis. Analysis will begin once data entry and cleaning of the full data set is complete, targeted for early 2012.

At the American Academy of Dermatology Annual Meeting in February 2011, Dr. Armstrong presented "Teledermatology 101: Integrating Teledermatology into Your Practice," which described sustainable models of teledermatology and how providers can develop strategies to incorporate teledermatology into their practices

Preliminary Impact and Findings: This project does not have any findings to date, as data analysis is forthcoming.

Target Population: Adults, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Use of Electronic Health Records for Addressing Overweight and Obesity in Primary Care

Principal Investigator:	Baer, Heather, Sc.D.
Organization:	Brigham and Women's Hospital
Mechanism:	PAR: HS09-087: Mentored Research Scientist Research Career Development Award (K01)
Grant Number:	K01 HS 019789
Project Period:	September 2010 – August 2015
AHRQ Funding Amount:	\$127,047

Summary: Obesity is widely recognized as a critical public health concern and is associated with increased risk of diabetes, cardiovascular disease, cancer, and all-cause mortality. Electronic health records (EHRs) have the potential to improve diagnosis and treatment of obesity by primary care clinicians. However, very few EHR-based tools have been developed or evaluated for this purpose.

The objectives of this research study are to develop and evaluate EHR-based tools for identification, diagnosis, and treatment of overweight and obese patients. This includes reminders, clinical decision support (CDS), and information for clinicians and patients. After these tools are developed and tested, a cluster-randomized controlled trial will be conducted in 12 diverse ambulatory clinics in the Boston, Massachusetts area to assess the effectiveness of the EHR-based tools in the identification, evaluation, and treatment of overweight and obese individuals in the primary care setting.

Specific Aims:

- Develop EHR-based tools to help primary care clinicians identify, evaluate, and treat patients who are overweight or obese. **(Ongoing)**
- Conduct a cluster-randomized controlled trial to assess the effectiveness of EHR-based tools for the identification, evaluation, and treatment of overweight and obesity in primary care. **(Upcoming)**

In addition to the specific research aims, as part of this Mentored Research Scientist Research Career Development Award, Dr. Baer, the Principal Investigator, is working toward the following long-term career goals: 1) to develop a multidisciplinary research program dedicated to developing and evaluating strategies to address obesity and other modifiable risk factors in the clinical setting; and 2) to teach and mentor individuals who wish to pursue careers in clinical epidemiology or health services research.

2011 Activities: The CDS tools for obesity were further developed in terms of specification of the components through review of other CDS tools and obesity research and the technical programming throughout 2011 in preparation for the cluster-randomized controlled trial. The research team completed a needs assessment of current clinical practice guidelines on the identification, evaluation, and management of overweight and obesity diagnosis. Based on this assessment, they developed detailed specifications for the design and content of the new tools within the EHR. An expert panel including primary care clinicians, nutritionists, and informaticians, reviewed and provided feedback on the proposed design and content of the new tools. The panel met twice in March and September 2011.

Dr. Baer presented to the practice leadership team in October to get the buy-in and support for primary care practices to participate in a randomized study of the EHR-based tools for obesity treatment. A survey was distributed to all participating providers to assess baseline data on their approach to weight management. A second survey on the same topic will be completed by providers once intervention is implemented.

The first stage of the evaluation process began in December 2011. Primary care clinics were randomized to the intervention group, which will have access to the new EHR-based tools, or the control group, which will receive care as usual. In the same month, reminders on height and weight were added to the EHR. These reminders are available to all of the clinicians in the intervention group. The research team planned how data that will be abstracted from the EHR and from other data sources for evaluation purposes, with most coming directly from the EHR (i.e., documentation of height and weight, weight management, and changes in clinical outcomes). In May 2012, additional features will be added to the EHR, including a screen that gives the provider options for weight management.

Preliminary Impact and Findings: A baseline survey of providers on their attitudes towards weight management was completed in fall 2011. Provider attitudes are an intermediate outcome of the research study. The survey was sent to 152 clinicians and completed by 85, for a response rate of 55.9 percent. Among respondents, 50.6 percent said that they always or often assess overweight and obese patients' motivation to lose weight, and 48.8 percent said that they always or often help motivated patients set a weight loss goal. Only 27.7 percent said that it was easy to access information about local resources for helping patients to lose weight. The vast majority (89.3 percent) said that they would like more help creating an appropriate weight loss plan for their patients.

Target Population: Adults, Obesity, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

The Impact of Health Information Technology on Demand for Inpatient Services

Principal Investigator:	Barrette, Eric, M.A.
Organization:	University of Minnesota, Twin Cities
Mechanism:	PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36)
Grant Number:	R36 HS 018272
Project Period:	September 2009 – April 2011
AHRQ Funding Amount:	\$24,642

Summary: The influence of health information technology (IT) on where consumers decide to receive hospital inpatient services is largely unknown. These decisions can affect the cost and quality of those services as well as the market power of hospitals. This project examined the role of health IT on inpatient health care service demand. This demand analysis complements existing supply-side analyses to provide more complete and dynamic estimates of the impact that health IT has on health care markets. It allows policymakers and the health care industry to make better decisions regarding optimal health IT adoption and implementation strategies.

The analysis required information about hospitals' characteristics and information technology as well as patients' characteristics and hospital choices from 1999 through 2006. Data needed to perform this analysis came from several sources. Hospital characteristics data were obtained from the American Hospital Association (AHA) annual survey. This database contains information on hospitals' physical and organizational characteristics such as location, number of full-time physicians, and number of beds. The AHA database was linked with the Health Information and Management Systems Society Analytics Database. This dataset contains detailed historical information on the health IT software, hardware, and infrastructure installed in the surveyed hospitals. Three types of health IT were evaluated: electronic medical records, computerized physician order entry, and picture archiving systems. Inpatient Medicare claims data were the source of patient-level characteristics and hospital choices.

The demand for hospital inpatient services was estimated using standard econometric choice models that included patient characteristics, hospital characteristics, and observed patient choices. A hospital's decision to implement health IT was considered a treatment or policy intervention, and the change in the total number of patients using the hospital was the outcome of interest. A discrete choice model was estimated using patient-level data to predict the probabilities of patients choosing each hospital in their choice set. The parameter estimates from these models show how health IT affects a patient's likely hospital choice. An aggregate level model was employed in situations where the data set was too large to estimate at an individual patient level.

Specific Aims:

- Measure the effect of hospital adoption of health IT on the demand for inpatient care. **(Achieved)**
- Estimate the impact of health IT by type of inpatient service. **(Achieved)**

- Evaluate the effect of changes in patient hospital choices using consumer surplus as a welfare measure. **(Achieved)**

2011 Activities: Model specifications were tested during this period to estimate the magnitude of the variables in the model. The impact of each of the variables was determined by the size and significance of the model parameter estimates. The project evaluated changes in patient hospital choices using consumer surplus as a welfare measure, and measured the effect of hospital adoption of health IT on the demand for inpatient care. A 6-month no-cost extension period was used to complete the data analysis. The project was completed by the end of 2011.

Preliminary Impact and Findings: The impact of health IT was small, if any, because it was not found to affect large numbers of patients' choices or have a large impact on overall hospital demand. The picture archiving systems variables and interaction terms in both the market level and individual choice models are jointly significant and expected consumer surplus is positive. Effects of the other technologies on demand were not significant. Although the value of health IT is positive, health IT's effect on market share may not be enough to justify the financial investments.

Target Population: Elderly*, Medicare

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision making through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Context-Aware Knowledge Delivery into Electronic Health Records

Principal Investigator:	Del Fiol, Guilherme, M.D., M.S., Ph.D.
Organization:	University of Utah
Mechanism:	PAR: HS09-087: Mentored Research Scientist Research Career Development Award (K01)
Grant Number:	K01 HS 018352
Project Period:	September 2009 – July 2013
AHRQ Funding Amount:	\$575,729

Summary: A main cause of errors in the health care system is gaps in information available to providers. The provision of just-in-time access to relevant knowledge is essential for the implementation of new care models. Immediately-available information helps patients and providers make better decisions. It helps providers explain patient care options and retrieve and manage the best, up-to-date knowledge available at the point of care.

This research project is developing, implementing, and evaluating a prototype for a scalable and widely deployable knowledge delivery service (the “knowledge broker”) that is capable of automatically delivering context-specific information from online resources into electronic health record (EHR) systems via a “knowledge dashboard.”

A systematic literature review in combination with focus groups is documenting provider knowledge needs and informing the development of the knowledge dashboard. Once developed, the knowledge dashboard will be integrated into an EHR for use by providers.

Four core design requirements drive the development of the knowledge broker to guarantee its scalability and deployability: 1) the architecture must be open, independent, standards-based, and services-oriented; 2) the knowledge base will be expandable to accommodate additional knowledge needs in various contexts; 3) the knowledge broker will be able to deliver knowledge through mechanisms other than a knowledge dashboard, such as info buttons; and 4) the knowledge broker will be able to account for the needs of and deliver knowledge to providers and patients. This approach will help the dashboard be a potential national model for knowledge delivery at the point of need.

This project will investigate why, how, and when users interact with the knowledge dashboard, as well as the effect of these interactions on the fulfillment of knowledge needs and decisionmaking. Finally, the study will identify areas and opportunities for system enhancement and expansion. An exploratory data analysis will determine the feasibility and planning of a future large-scale quantitative investigation.

Specific Aims:

- Build a knowledge base of patients’ and providers’ knowledge needs. **(Ongoing)**
- Design, develop, and evaluate the usability of a scalable, widely deployable knowledge delivery service in a laboratory setting. **(Ongoing)**

- Conduct a mixed-method assessment of a pilot implementation of the knowledge broker in a real-world medical home environment. (**Upcoming**)

2011 Activities: Dr. Del Fiol worked on the systematic review, completing the full-text data extraction and working on search strategies for other databases. A complete abstract screening of EMBASE, CINAHL, and PubMed citations yielded a total of 21,445 abstracts. Two reviewers conducted a full-text screening and data abstraction of 200 articles with excellent agreement between reviewers.

Dr. Del Fiol evaluated the info button standard related to implementation. There is a lack of such evaluation studies and few organizations have done work in this area before from which inferences can be drawn. A broad sample of 17 health care organizations, EHR vendors, and knowledge publishers were interviewed regarding the info button standard, which provided important insights for this aspect of the project.

Substantial progress was made on the development of the knowledge broker software, which was completed in February 2011. There is an open-source agreement signed between the three partners and their institutions. The software was deployed at the University of Utah and the Veteran's Administration successfully integrated it into their Web-based EHR.

A significant amount of time was dedicated to the development and submission of three grants, based partly on the results of this K01 project.

Preliminary Impact and Findings: The systematic review of literature is showing significant recall bias among physicians on information not related to specific patient encounters. This recall bias results in a general underestimation of the number of questions that they have about patient care. Real-time observation is the most accurate way to understand information needs further. As a result, this is the approach that the project will take.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Using Health Information Technology to Support Population-Based Clinical Practice

Principal Investigator:	Gesteland, Per, M.D., M.S.
Organization:	University of Utah
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 018538
Project Period:	September 2009 – July 2014
AHRQ Funding Amount:	\$795,960

Summary: Acute respiratory infections (ARIs) are a burden to the health care delivery system and the public's health. The overuse of antibiotics for viral infections has contributed to the emergence of antimicrobial resistance and a substantial number of adverse drug events. As a result, research on preventing the overuse of antibiotics is a national priority. This project aims to improve providers' and patients' ability to distinguish viral infections from bacterial infections by providing timely, accessible information about the local incidence of common respiratory viruses via a population health repository and related decision support tools.

Intermountain Healthcare's Primary Children's Medical Center, which is affiliated with the University of Utah Department of Pediatrics, developed GermWatch  (<http://www.intermountainphysician.net/gw>), a reporting system for pediatric and adult respiratory infections that captures routine microbiological testing data from all Intermountain Healthcare system practices. The system generates reports that display pathogen-specific data in graphs and maps that are distributed with a bulleted summary to more than 400 clinicians in the Intermountain west every week. The reports are also available on the GermWatch Web site, which provides a user interface that supports custom queries based on time-periods, age ranges, pathogens, and regions. The overall goal of the project is to refine this dashboard and further integrate it into clinical workflow. This study will address important gaps in patients' and providers' population-based health knowledge and the information technology tools required to fill them.

Specific Aims:

- Assess primary care clinician use of current population-based ARI health information resources and decision support tools using focus groups and structured observation. **(Ongoing)**
- Refine population-based ARI health information resources and decision support tools to improve clinical information system workflow integration and patient communication. **(Ongoing)**
- Implement these population-based ARI health information resources and decision support tools in primary and urgent care settings. **(Upcoming)**
- Measure the effects of population-based ARI health information resources and decision support tools on population-based clinical practice and patient and parent compliance to increase the effectiveness and appropriateness of antibiotic prescribing for ARI. **(Upcoming)**

In addition to the research project goals, Dr. Gesteland aims to further his long-term career goal of utilizing information technology and clinical information systems to optimize the management of common diseases that affect the health of adults and children. Funding from this Mentored Clinical Scientist Research Career Development Award will allow Dr. Gesteland to advance his skills through mentorship by experts in advanced epidemiologic and statistical methods, health services research, cognitive psychology of medical decisionmaking, integrated medical systems, health care quality improvement, and biomedical informatics.

2011 Activities: Dr. Gesteland made significant progress on the first two aims during 2011. He sought to determine how providers use population-based ARI health information resources and decision support tools and understand the level of interest parents of patients have in accessing viral epidemic data. The research team conducted interviews with providers to inform the development of the dashboard style reports and to elucidate design objectives for the Web site redesign. Specifically, the team sought to understand how current data visualizations could be improved and what additional content and tools (e.g., patient education, ARI guidelines, information about viral testing) providers need and where in the clinical information system and clinic workflow would providers prefer to access these resources. The interviews also identified new issues, including providers' comfort level with office staff access to GermWatch and with tailoring information appropriately for parent access. These refinements are ongoing.

Based on input from parent focus groups, the research team began developing a public-facing version of the GermWatch system, which will have content designed specifically to meet the information needs of patients and parents relevant to common respiratory pathogens and the related ARI they cause. General design, layout, and storyboard development are complete and individual page content has been drafted. The public-facing Web site will be beta tested with Intermountain employees in summer 2012. This site will serve as the companion tool that clinics can give patients who want to learn more about conditions and specific pathogens. The pediatric infectious disease (ID) team will conduct a critical review of the content to ensure that messages are well articulated for specific pathogens. Dr. Gesteland is also working on the process of message authoring with public relations, in collaboration with ID colleagues and media relations personnel from State and local health departments.

On the provider interface, new dashboard style reports have been developed and refinements to the GermWatch provider-facing site that incorporate the dashboard components are underway. Some mock-ups have been developed, and navigation improvements have been discussed. Refinements to the GermWatch infrastructure include improvements to the GermWatch database with new schemas that support analysis at the level of a viral 'episode of care,' new data types (ICD-9 coded visits), and a quality assurance check before data becomes public. Newly developed functionality includes the ability to monitor influenza-like illness, measles, and pertussis outbreaks automatically. In addition, the system now has the ability to look at antibiotic resistance information in many different ways, for example, by region, by condition (e.g., skin and soft tissue infections, febrile infant), or hospital versus ambulatory information.

A primary focus during the year was on project dissemination and manuscript development. The development of the dashboard was presented in May at the meeting of the Pediatric Academic Societies. Dr. Gesteland presented a paper, [The EpiCanvas Infectious Disease Weather Map: An Interactive Visual Exploration of Temporal and Spatial Correlations](#), at the 2011 American Medical Informatics Association Symposium. This paper won the Homer R. Warner Award and is now available as an e-publication in the

Journal of the American Medical Informatics Association. Dr. Gesteland is working on integrating this “infectious disease weather map,” which depicts regional infectious disease activity at-a-glance into the GermWatch system.

Preliminary Impact and Findings: Parents participating in focus groups reported interest in having access to the type of information about common viral epidemics that the GermWatch system provides.

Target Population: Acute Respiratory Infections, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

EHR Use and Care Coordination

Principal Investigator:	Graetz, Ilana, B.A.
Organization:	University of California, Berkeley
Mechanism:	PAR: HS09-212: AHRQ Grants for Health Services Research Dissertation Program (R36)
Grant Number:	R36 HS 021082
Project Period:	September 2011 – August 2012
AHRQ Funding Amount:	\$41,276

Summary: While electronic health record (EHR) systems have been consistently promoted as a policy priority for improving the quality and efficiency of the U.S. health care system, there is limited research evidence to inform policymakers about the effects of EHR use on care coordination. This study is using a quasi-experimental design with concurrent controls to evaluate the impact of outpatient physician use of a newly-implemented, certified EHR system at Kaiser Permanente Northern California (KPNC) on measures of care coordination and, in turn, the association between care coordination and care quality for patients receiving care from multiple clinicians. The study includes 110 primary care teams in 18 medical centers within the KPNC delivery system, which served more than 2 million adult patients 18-years-and-older between the years 2005 and 2008.

Researchers are examining the association between EHR use and care coordination, while adjusting for clinician characteristics and organizational factors. They are further examining whether the association between EHR use and care coordination varies by team climate. Measures of care coordination and team climate are being captured using existing self-administered survey responses collected from primary care clinicians in 2005, 2006, and 2008 during the staggered implementation of the EHR system. Quality and clinical outcome measures are captured using the health system's automated databases. They include guideline-adherent prescription drug use and laboratory monitoring, and physiologic disease control for diabetes patients receiving care from multiple clinicians.

This study uses existing data, including survey responses that capture detailed measures of clinician-reported care coordination and team climate at multiple points in time, as well as substantial data resources from the study setting. The staggered nature of the EHR implementation allows for adjustment of secular changes.

The outcomes of this study will provide evidence of the impact of EHR use on care coordination and quality improvement. In the current clinical environment, where care provided to patients is increasingly fragmented and complex, effective care coordination is essential. The EHR offers new opportunities for improving overall quality of care, preventing medical errors, and reducing health care costs.

The principal investigator (PI) is researching the impact of EHR use on care coordination and clinical quality for patients with complex health care needs for her dissertation. For the last 7 years, she has been working with Kaiser Permanente on a long-term study to examine the impact of new health IT on clinical care. She completed preliminary analyses based upon the data sources used in this study and will build upon this work and her experience as a doctoral candidate in University of California Berkeley's Health Services.

Specific Aims:

- Examine the association between EHR use and care coordination among teams with positive and negative reports of team climate, while adjusting for patient, physician, team, and medical center characteristics. **(Ongoing)**
- Examine the association between care coordination and clinical care quality for patients receiving care from multiple clinicians. **(Ongoing)**

2011 Activities: The project focused on analysis of data sets obtained from Kaiser Permanente to examine the relation of EHR use and process and outcome measures such as test intervals and HgA1c levels respectively.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Chronic Care*, Diabetes

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions and the electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Evaluating Electronic Health Record Data for Use in Diabetes Quality Reporting

Principal Investigator:	Hirsch, Annemarie, M.P.H.
Organization:	The Ohio State University
Mechanism:	PAR: HS09-212: AHRQ Grants for Health Services Research Dissertation Program (R36)
Grant Number:	R36 HS 020165
Project Period:	March 2011 – June 2012
AHRQ Funding Amount:	\$37,920

Summary: Adoption rates of electronic health record (EHR) systems and pay-for-performance (P4P) programs have been increasing. These two innovations have now merged as the Center for Medicare and Medicaid Services (CMS) has started to permit the use of EHR data for reporting P4P quality measures. While research exists on the challenges of using claims and registry data for P4P programs, there is little guidance on how to use EHR data for quality reporting. Few studies have explored the validity of using EHR data to identify a target population or examined specifically how the use of EHR data can impact quality measures. In addition, there is little information on the accuracy and consistency of EHR data, specifically on how physicians use the EHR data to store information about patient diagnoses.

Despite this lack of information, P4P programs are expanding their use of EHR data, which may be a particular concern given that existing quality measures are often perceived by physicians to not accurately measure quality. Before using this data for quality reporting, it is critical to understand how physicians use the EHR and what motivates their choices.

Ms. Hirsch is evaluating the validity of using EHR data in P4P measures, specifically focusing on quality measures in diabetes, one of the conditions for which CMS permits the use of EHR data. She is evaluating the validity of using different combinations of EHR data elements to identify patients with diabetes by comparing these EHR approaches to a gold-standard manual medical record review and determining how different approaches to using EHR data impact the proportion of patients who meet quality standards. The findings will provide guidance, which is currently unavailable, on how to best leverage existing EHR data to monitor health care quality.

Specific Aims:

- Evaluate the validity of different EHR criteria in identifying primary care patients with diabetes. **(Ongoing)**
- Determine the impact of utilizing different EHR criteria on existing quality measures for diabetes. **(Ongoing)**
- Learn where in the EHR physicians document diagnoses of diabetes and identify motivators of documentation behaviors. **(Achieved)**

2011 Activities: The majority of the work for this project, funded through the Health Services Research Dissertation grant program (R36), was completed in 2011. Activities included requesting, receiving,

and cleaning the data extracts for the eight approaches to identifying diabetics using EHR data from the Geisinger Health System. The project team conducted a medical chart review to establish the gold standard of diabetic diagnosis with which to compare the eight sets of criteria. This included analyzing de-identified clinical notes from the EHR. At the end of 2011, data analysis was ongoing. To learn where in the EHR physicians document diagnoses of diabetes and identify motivators of documentation behaviors, 17 semi-structured interviews were conducted with primary care providers. One change from the original application was to include physician assistants and nurse practitioners in addition to physicians. Ms. Hirsch developed a coding scheme and qualitative analysis of the interviews is complete. Two manuscripts from this aim were drafted but are on hold until analyses for the first two aims are complete.

Budget spending was lower than anticipated due to lower costs associated with interviews because of reaching saturation on the qualitative interviews earlier than anticipated. Therefore Ms. Hirsch is using a 3-month no-cost extension (NCE) to continue to develop manuscripts. The NCE was approved through the end of June 2012.

Preliminary Impact and Findings: The most significant finding so far is that organizational factors are a major driver of documentation in the EHR. These organizational factors include pressure from leadership (e.g., encouragement to document information in a particular way), institutional procedures (e.g., automatic generation of diagnoses when providers place specific clinical orders), and existing internal quality programs (e.g., providers are more motivated to document diagnoses if participation in quality initiatives is dependent on documenting the diagnosis in the EHR). The influence of organizational factors on EHR data makes it much harder to come up with standard EHR specifications for performance measurement that can be applied across institutions.

There are some unintended consequences of using EHR data to drive quality management efforts. For example, physicians have expressed concerns about how diagnoses generated by EHR data algorithms might be used (e.g., labeling someone in the EHR that could have insurance implications or a patient finding out about a diagnosis through a patient portal before being told by the physician.)

Target Population: Chronic Care*, Diabetes

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision-making through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Patient Readiness to Use Internet Health Resources

Principal Investigator:	Koopman, Richelle, M.D., M.S.C.R.
Organization:	University of Missouri, Columbia
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 017948
Project Period:	March 2009 – February 2014
AHRQ Funding Amount:	\$723,592

Summary: As the burden of chronic disease increases in the United States and throughout the world, new approaches are needed to adequately care for people with chronic conditions. The Chronic Care Model suggests processes and systems that can help optimize the care of patients with chronic disease. It emphasizes patient self-activation because activated patients are prepared to take a collaborative, if not central, role in managing their own health. Online health resources could potentially provide a sustainable and patient-centered format for delivering the education, communication, and self-management resources needed to optimize patient activation. However, Web-based resources for chronically ill patients are only valuable if patients have the computer skills and motivation to use them.

This project examines patient readiness, in terms of both aptitude and desire, to use Web-based health resources such as patient education, self-management tools, online prescription refills, requests, medication reconciliation, and secure messaging. The study looks at the relationship between motivation for behavioral change and the use of online health resources and interactive online communication between the patient and the health care team. To help examine the question of patient readiness, the project team is developing a practical measure of the readiness of ambulatory patients with chronic conditions to use Web-based health resources. This examination of preferences for use of Web-based health resources among ambulatory patients with chronic disease will inform projects, systems, and policies that seek to use the online environment as part of a comprehensive disease management strategy.

Specific Aims:

- Develop a measure of the readiness (aptitude and desire) of patients with chronic conditions attending primary care clinics to use Web-based health resources for health information exchange. This measure will be called the Electronic Health Information Exchange Readiness Scale (E-HIERS). **(Achieved)**
- Determine how the frequency and type of use of Web-based health resources are associated with improvements in clinical measures for patients with type 2 diabetes. **(Ongoing)**

2011 Activities: Activities focused on study participant recruitment, data extraction from the patient portal (called IQ Health), factor analysis, and readiness scale development. Dr. Koopman began with an exploratory analysis on items and then looked at those items pre- and post-test. The feasibility testing for the scale included 50 items and the final scale included 28 items. Data extraction began and is informing the patient validation of the instrument because usage data can be correlated with scores from the final scale. Recruitment of participants was on target. The institutional review board has granted approval for the remaining study activities.

Preliminary Impact and Findings: Dr. Koopman developed a manuscript to be submitted based on the focus group findings from 2010, which indicated that promoters of online health resource use included speed, convenience, and the ability to look up information before a visit with a physician. Primary barriers to online health resource use included Internet security and privacy concerns. Some general conclusions drawn from the results are that the use of online information among patients with chronic conditions is an accessory to their relationship with their physician, that patients with less-established relationships may rely on the Internet more heavily, and that patients are using the Internet to enhance care by becoming more informed consumers, confirming the Chronic Care Model. These results were used to inform development of the scale to measure patient readiness to use Internet health resources.

Target Population: Adults, Chronic Care*, Diabetes

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Knowledge Engineering for Decision Support in Osteoporosis

Principal Investigator:	LaFleur, Joanne, Pharm.D., M.S.P.H.
Organization:	University of Utah
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 018582
Project Period:	January 2010 – December 2014
AHRQ Funding Amount:	\$805,680

Summary: There are many barriers to the diagnosis and treatment of osteoporosis. They include process barriers, such as workflow and organization, and information and cognitive barriers, such as the saliency of the problem and suboptimal organization of information relevant to the treatment decision. Specific cognitive barriers to identifying and treating osteoporosis include failure to identify that a patient is at high risk for a fragility fracture, not knowing what level of risk justifies treatment, and uncertainty about when to initiate treatment. These are some of the reasons why, despite the high burden of osteoporosis, fewer than 25 percent of veterans who are at risk for fracture are currently treated for osteoporosis.

While computerized clinical decision support has the potential to improve appropriate treatment rates by identifying patients at risk, such systems are often poorly developed and may not reflect physicians' models for conducting clinical tasks or preferences for structuring tasks and navigating systems, thus reducing the system's optimal impact.

The overall goal of this project is to develop robust knowledge for supporting accurate osteoporosis-related treatment decisions to address these information barriers. Dr. LaFleur and her team are using electronic and survey data to create a new risk-stratification rule. This rule will adapt a currently accepted risk-stratification rule and the World Health Organization's treatment guidelines for the veteran population, identify information constructs that are important to clinicians for supporting the correct treatment decision. The findings will inform the development and pilot testing of a new tool.

While this project is focused on a specific clinical topic and setting, its approach to providing decision support at the point of care by integrating treatment guidelines, characteristics of the target population, and information needs of clinicians, could become a decision support template for other diseases and conditions.

Specific Aims:

- Create and validate a Veterans' Affairs (VA)-specific risk-stratification rule for fragility fractures. **(Ongoing)**
- Incorporate the risk-stratification rule into a computerized decision support system for osteoporosis treatment. **(Ongoing)**
- Pilot the decision support tool for initiating osteoporosis treatment. **(Upcoming)**

In addition to the research project goals, Dr. LaFleur will further her long-term career goal of identifying and preventing drug-therapy failures in chronic disease populations. Funding from this

Mentored Clinical Scientist Research Career Development Award will allow Dr. LaFleur to advance her skills in health services research through structured coursework, regular seminars, and mentoring in the fields of clinical informatics, decision modeling, epidemiologic methods, and statistical approaches.

2011 Activities: The development of the risk-stratification rule was almost complete during the year pending the addition of Medicare data to the dataset. The dataset currently combines variables related to fracture risk from three Veterans Affairs (VA) datasets: 1) the Medical SAS Dataset (all inpatient and outpatient services provided to veterans); 2) the Corporate Data Warehouse (clinical patient care information from VistA, the VA's electronic health record); and 3) the Pharmacy Benefits Management Dataset (records of prescriptions dispensed to veterans to identify drug exposures related to risk). The model incorporates outcome data from the Medical SAS dataset for fractures that were treated within the VA system, and outcome data from the Medicare-VA dataset to capture fractures that were treated outside the VA system. It took several months to receive approval from the Centers for Medicare and Medicaid Services (CMS) to access and integrate Medicare data into the tool. At the end of the year, Dr. LaFleur was still waiting to receive the Medicare data. During the year, she developed the preliminary models to validate the rule that does not contain the CMS outcomes, including models for bone mineral density, body mass index, smoking history, and family history of fracture. Once the CMS data are integrated into the models, Dr. LaFleur will calibrate the rule. This involves surveying veterans on risk factors for fracture using an existing survey that the project team adapted to assess risk factors for osteoporosis.

Even though the development of the rule is not complete, Dr. LaFleur has been able to begin the second aim, which involves conducting focus groups with providers and developing a series of case vignettes to identify risk factors and fracture risk constructs that are associated with osteoporosis treatment. These fictional patient cases are designed to include information that clinicians would typically have at their disposal when seeing patients. This will allow Dr. LaFleur to ask providers questions about the kinds of clinical information that are most important to help them make decisions about osteoporosis. The study team is scheduling focus groups for three sites, two VA and one non-VA site, to be conducted in early 2012.

One change from the original grant proposal was the addition into the rule of bone mineral density screening. While bone mineral density screenings are predictive of fracture risk, they are not codified anywhere in the electronic data. However, Dr. LaFleur and her team used natural-language processing software to integrate these screenings into the model as a variable. Dr. LaFleur presented this process at the American Society of Bone Mineral Research meeting in September 2011.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Osteoporosis, Veterans

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Using Health Information Technology to Improve Delivery of HPV Vaccine

Principal Investigator:	Rand, Cynthia M., M.S., M.D., M.P.H.
Organization:	University of Rochester
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 017951
Project Period:	September 2009 – September 2014
AHRQ Funding Amount:	\$745,995

Summary: The vaccine to prevent human papillomavirus (HPV) infection is now recommended for all females aged 11-to-26 years. The vaccine is highly effective if all three doses are received prior to exposure to HPV. Barriers to completion of the three-dose HPV vaccine regimen include health care provider factors (e.g., competing health care priorities during medical visits), and parent or adolescent factors that prevent patients from returning for booster doses.

This project will determine whether the use of electronic patient reminders can shorten intervals between HPV vaccine doses and increase overall rates of completion of HPV vaccination regimen in inner-city areas compared to practices without reminders. Dr. Rand has planned two health information technology (IT) interventions. The first and primary intervention will be a reminder, delivered by telephone or text message, to patients for followup doses of vaccine. The second will use electronic medical record prompts for providers to reduce missed opportunities for immunization. Prompting effectiveness will be measured using a before-and-after study design.

Quantitative interviews with parents of adolescent girls and the girls themselves guided the intervention design. The study will perform a retrospective cross-sectional analysis of the intervention in four inner-city primary care practices. Post-intervention rates of missed opportunities for HPV vaccination, intervals between vaccine doses, overall rates of completed HPV vaccination courses, and health maintenance visits will be measured in several intervals at each practice. The study will analyze data to assess the overall effectiveness of the prompting and patient reminder intervention in reducing missed opportunities and improving vaccination completion rates. The project will also assess rates of health maintenance visits and other vaccinations for adolescents in intervention and comparison practices. Outcomes will be measured at baseline, the electronic patient reminder will be implemented, and summary statistics will be generated 6-, 12-, and 18-months after the intervention begins.

Specific Aims:

- Measure parent and adolescent preferences for methods of communication with the adolescent's provider. **(Achieved)**
- Measure baseline rates of missed opportunities for HPV vaccination, the intervals between HPV vaccine doses, and the proportion of patients who received one, two, or three vaccinations. **(Ongoing)**

- Develop and implement a health IT-based intervention to reduce missed opportunities, reduce intervals between doses, and increase completion of the HPV vaccination series in inner-city practices. **(Ongoing)**
- Measure post-intervention rates and analyze data. **(Upcoming)**
- Complete educational objectives. **(Ongoing)**

In addition to the specific research project aims, as part of this Mentored Clinical Scientist Research Career Development Award, Dr. Rand will complete the following education objectives: 1) learn health informatics theory and be able to apply it to both clinical decision support for providers and self-management support for patients; 2) become expert in implementing and sustaining quality improvement (QI) projects based in health IT and teach these skills to other health care providers; 3) implement qualitative research methods and develop advanced skills in the application of quantitative statistical methods; 4) improve career skills by writing manuscripts and competitive grants; and 5) network with leaders in health IT, immunization delivery, QI, and adolescent preventive health.

2011 Activities: Surveying of adolescents and their parents has been completed and a preliminary analysis done. Further analysis and development of a manuscript is ongoing. Dr. Rand reduced the number of practices from four to three because the electronic medical record implementation was significantly delayed in one practice. As a result, the study was revised to randomize the patients instead of the practices. There are no anticipated changes to the timeline nor anticipated impact on the project based on these changes. Institutional Review Board approval was obtained for all practices and baseline data was collected for one.

Dr. Rand completed courses in qualitative research and consumer health informatics. She has one more credit to be complete, which she expects to fulfill through a mentorship in Maine.

Preliminary Impact and Findings: Project results indicate that 95 percent of urban and 99 percent of suburban parents own a cell phone. Ninety percent reported at least weekly use of the Internet and 81 percent weekly use of e-mail. Eighty-seven percent of urban and 95 percent of suburban parents use text messaging (TM) and most do not pay for that service. Overall, 52 percent of parents would accept TM reminders, with no difference in acceptability based on parent gender, insurance, or residence. Parents were more likely to accept TM reminders if they were younger and not charged for TM, with no difference based upon residence.

Target Population: Adults, Inner City*, Teenagers, Women*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

The Effects of Age, Cognition, and Health Literacy on Use of a Patient Electronic Medical Record

Principal Investigator:	Taha, Jessica R., M.S.
Organization:	University of Miami
Mechanism:	PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36)
Grant Number:	R36 HS 018239
Project Period:	September 2009 – November 2011
AHRQ Funding Amount:	\$37,800

Summary: The use of patient portals of electronic medical records (EMRs) is expanding as patient involvement in disease prevention, management, and decisionmaking is increasingly emphasized in the health care system. To date, there has been little usability testing of patient portals, especially with older adult populations. This study, funded through the Health Services Research Dissertation grant program (R36), systematically assessed the ability of middle-aged and older adults to use a simulated patient portal of an EMR to perform common health management tasks. The study also examined the effects of age, Internet experience, and individual characteristics—such as health literacy, numeracy, and cognitive abilities—on the use of such systems.

Participants included people aged 40-to-85 years with a range of health literacy and numeracy abilities. The specific focus was on three common health management tasks associated with patient portals: 1) medication management; 2) interpreting laboratory test results; and 3) health maintenance activities. By assessing the relationship between individual characteristics and the ability to use a patient portal of an EMR system, the study identified the root of a number of usability problems and then proposed a set of empirically-based interventions to help those who are most likely to have problems interacting with these systems. At the same time, this research aimed to increase the general usability of these systems, which will ultimately benefit all patient populations.

Participants completed background and technology experience questionnaires to gather data including gender, age, ethnicity, educational level, income, health information, medication use, and experience with technology such as computers and the Internet. Participants were also given the Test of Functional Health Literacy in Adults (TOFHLA) and subjective and objective numeracy tests. Following the administration of the testing components of the study, participants completed a tutorial on basic computer skills (e.g., using a mouse, scrolling) and were given basic instruction on how to navigate the EMR record and view its information. Each participant then used the simulated portal to perform fifteen tasks encompassing medication management, review/interpretation of laboratory and other test results, and health maintenance activities. Tasks were designed to evaluate basic, computational, analytical, and statistical numeracy ability. Furthermore, each of the tasks was classified in terms of being “simple” or “complex.” Following the completion of the tasks, participants were asked to complete a portal usability questionnaire. At the completion of data collection, each participant was interviewed briefly to get additional feedback on use of the patient portal.

Specific Aims:

- Examine the ability of middle-aged and older adults to use a patient portal of an EMR to perform common health management tasks. **(Achieved)**
- Examine the relationships between individual characteristics such as age, cognitive abilities, health literacy, and task performance. **(Achieved)**
- Identify usability problems inherent in the use of patient portals and identify design solutions. **(Achieved)**

2011 Activities: At the suggestion of Ms. Taha's academic advisors at the University of Miami, the sample size increased from 80 to 100. However, Ms. Taha felt there might still be insufficient variability in race and ethnicity and so focused on additional recruitment, bringing the total number of participants to 107. A 3-month no-cost extension enabled the completion of the data collection, analysis, and manuscript development, which were the primary focus of activities during this period. This project was completed in November 2011.

Impact and Findings: Eighty-five of the participants reported varying levels of Internet experience. To create a variable that captured the participants' overall Internet experience, the duration of their Internet use and their frequency of use was combined into a single score ranging from 1-to-16. The 22 participants (11 middle-aged and 11 older) who reported having no Internet experience were given a score of "0".

After accounting for education, Internet experience was found to be a significant predictor of performance on simple and complex tasks and overall task performance. In addition to education and Internet experience, cognitive variables were also found to significantly predict performance, such that those with lower verbal ability, executive functioning, and reasoning skills had lower performance on tasks. Even after accounting for all of these variables, numeracy was determined to significantly predict performance on complex tasks and overall performance. With regard to task performance, age did not significantly predict performance on simple tasks but it was significant in predicting performance on complex tasks and overall performance. Results from this study also indicated that both middle-aged and older adults tended to overestimate their numeracy skills, and that the older participants had less correlation between subjective and objective numeracy measures than middle-aged participants.

Approximately 89 percent of all participants indicated that they would use a patient portal like the simulation if it were available from their doctor. Of those who indicated that they would not be interested in using a portal, five were middle-aged and seven were older. Many of these participants thought that the portal was "confusing" or "difficult" to use. However, among those who said that they would not use a patient portal like the simulation, only one participant thought there was no benefit in using a portal. The other participants who indicated that they would not use a portal acknowledged certain benefits including the ability to get test results or medication information without having to leave the house or call a doctor, to schedule and keep track of appointments, and to find information pertinent to health conditions through portal links.

Both middle-aged and older participants tended to have a positive opinion of patient portals in general. Ninety-four percent of participants either agreed or somewhat agreed that a patient portal would improve their ability to perform health management tasks, and 95 percent either agreed or somewhat agreed that a patient portal would allow them to get information that would help them understand issues related to

their health. However, participants did have some difficulty in using the portal simulation: 40 percent of participants indicated that it was difficult to navigate within the portal, and 51 percent thought that it was difficult to locate the information that they needed within the portal.

Target Population: Adults, Elderly*, Low Literacy

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Creating a Foundation for the Design of Culturally-Informed Health Information Technology

Principal Investigator:	Valdez, Rupa Sheth, M.S.
Organization:	University of Wisconsin Madison
Mechanism:	PAR: HS06-118: AHRQ Grants for Health Services Research Dissertation (R36)
Grant Number:	R36 HS 018809
Project Period:	February 2010 – July 2012
AHRQ Funding Amount:	\$34,003

Summary: When properly presented, consumer health information technology (IT) has the potential to increase the involvement of patients and their supporters in the improvement of their health. An approach to confronting racial and ethnic health care disparities has been to develop initiatives to enhance the cultural appropriateness of health care. To date, such efforts have focused predominantly on culturally tailoring provider-delivered care, health care systems, and health promotion campaigns. Given the expanding importance of health IT used by patients and their social network, and the fact that most technology is embedded with strong but unrecognized cultural orientations, expanding health IT design to purposefully include salient cultural dimensions may help reduce these disparities.

The long-term objective of this Health Services Research Dissertation (R36) grant is to reduce racial and ethnic health care disparities by creating new, culturally-responsive approaches to the design of health IT for use by patients and members of their social network (e.g., family, friends, neighbors). The goal is to create a foundation for a design strategy that leads to culturally-informed consumer health IT. A concurrent, mixed-methods approach drawing on both anthropological and systems engineering methods is being used to assess culturally diverse patients' daily routines of health information communication.

The outcome of this analysis will be a set of design considerations for culturally informed health IT. These design considerations will specify where similarities and differences in needed functionalities and means exist across individuals of diverse cultural identities.

Specific Aims:

- Determine the daily routines of health information communication exhibited by patients holding diverse cultural identities. **(Ongoing)**
- Determine what design considerations for consumer health IT result from knowledge of these daily routines. **(Ongoing)**

2011 Activities: Originally, Ms. Valdez proposed conducting one interview with each of the 30 participants to determine the health information communication routines of culturally diverse patients. Ultimately, however, two interviews with each participant were conducted in order to probe deeper into their social networks and their choices on health information communication. In the first interview, participants were asked to create a visual depiction of their social network. Participants were then presented with different types of health information—daily observations of health status, test results from clinical visits,

information on diabetes self-care and self-management, and time and place of doctor's appointments—and asked if and how they communicated this information to each member in their social network. At the second interview, conducted 1-to-2 weeks later, participants were asked to validate the information from the first interview, identify how certain aspects of their culture affects what kind of health information they share or do not share, and to describe their use of technology in general.

Data collection, a focus in 2011, was completed by the end of the year. A total of 34 individuals were screened, 18 of whom participated in two interviews. Qualitative data analysis is ongoing and will be completed in 2012.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

MyHealthPortal: Using an Electronic Portal to Empower Patients with Breast Cancer

Principal Investigator:	Wen, Kuang-Yi, Ph.D., M.S.
Organization:	Fox Chase Cancer Center
Mechanism:	PAR: HS09-087: Mentored Research Scientist Research Career Development Award (K01)
Grant Number:	K01 HS 019001
Project Period:	August 2011 - July 2016
AHRQ Funding Amount:	\$747,959

Summary: Patient use of online electronic medical records has the potential to improve health outcomes. Educational materials that are made available within a patient-accessible electronic medical record (PAMR) will not only help patients understand their clinical data, but will also support them through use of integrated behavioral and health communication strategies in a comprehensive format that contributes to optimum care. Breast cancer, the most common cancer and the second-leading cause of cancer deaths among women, accounts for 29 percent of all new cancer diagnoses in the United States. A diagnosis of breast cancer often evokes fear and distress. Studies show that breast cancer patients report that their providers often fail to understand their psychosocial and communication needs in addition to their need for information and skills to manage their illness and deal with the major life changes and potential emotional problems that usually accompany it. To bridge the divide between patients and the health care system, one objective of this research is to integrate personal information from an electronic medical record with educational and support content about breast cancer treatment decisionmaking and care management into the MyHealthPortal patient portal. A second project objective of this Mentored Research Scientist Research Career Development Award is to enhance the principal investigator's career development through education and training activities.

Using an iterative developmental process, this work will be accomplished through four phases of the research plan to ensure a user-centered design, and the acceptance of the portal among both the targeted audience and health care providers. Phase 1 includes survey research to assess existing institutional portal users' satisfaction with the current portal and to identify features in need of improvement. Phase 2 consists of a qualitative study to identify breast cancer patients' information needs and preference for a PAMR-integrated portal. Phase 3 includes a qualitative study to explore breast cancer clinicians' attitudes and expectations regarding the implementation of a patient portal that integrates shared medical records and e-communication capability that will impact doctor-patient relationship. Phase 4 includes both cognitive user and usability testing for system refinement to maximize MyHealthPortal's usefulness and patient satisfaction. Once fully developed, the study will evaluate the feasibility of the portal system in a pilot randomized controlled trial study with 120 breast cancer patients to examine the impact of the MyHealthPortal system on patient outcomes including: cancer-related distress, information competence, coping self-efficacy, physical quality of life, and doctor-patient communication. Intervention participants' satisfaction with and usage of the MyHealthPortal system will also be evaluated.

The findings of this research and the developmental process that it will employ will be applicable to the breast cancer population, but could also serve as a model for PAMR-integrated system development and implementation among other cancer populations. The research will also provide preliminary data to support a R01 proposal that will examine the efficacy and cost-effectiveness of the MyHealthPortal system in a larger study.

Dr. Wen identified a mentorship team suited to provide expertise in major areas of relevance to the research activities. Enrollment in three core courses will advance the investigator's career and research goals. Dr. Wen will attend a series of seminars and workshops as well as present and attend at annual meetings and conferences across a variety of research topics directly related to the training needs identified by the mentorship team.

Specific Aims:

- Develop a patient-centered Web-based portal (MyHealthPortal) for breast cancer patients undergoing treatment in a Comprehensive Cancer Center. **(Ongoing)**
- Conduct a pilot randomized controlled trial study to assess the feasibility and potential impact of the MyHealthPortal system with early-stage breast cancer patients. **(Ongoing)**

2011 Activities: The project began in August 2011 and focused primarily on project start-up activities including the preparation of materials for institutional review board approval. Recruitment of study subjects was initiated and Dr. Wen began the subject interview process. Completed interviews were transcribed and reviewed. The medical component of the portal was finished and additional content is in progress.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Cancer: Breast Cancer, Women*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions and the electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

** This target population is one of AHRQ's priority populations.*

Improving Management of Test Results That Return After Hospital Discharge

Principal Investigator:	Were, Martin, M.D., M.S.
Organization:	Indiana University
Mechanism:	PAR: HS09-085: Mentored Clinical Scientist Research Career Development Award (K08)
Grant Number:	K08 HS 018539
Project Period:	October 2009 – September 2013
AHRQ Funding Amount:	\$577,880

Summary: Hospital patients discharged with pending test results are at risk for medical errors related to missed results for those tests. These errors may arise from poor methods of managing test results and poor communication with followup providers. Discharge summaries, the main mode of inpatient-to-outpatient communication, remain highly inadequate at documenting tests with pending results at discharge. While the problems related to poor management of test results returning after hospital discharge is widely acknowledged, little has been done to implement and evaluate interventions to improve existing systems.

This project is implementing and evaluating two health information technology (IT) interventions aimed at improving management of tests with pending results at hospital discharge. The first is a tool, the Pending Test Processor (PTP), which automatically identifies tests with pending results at hospital discharge and incorporates these tests into the discharge summary. The second is a modification of the DOCS4DOCS® clinical-messaging tool to deliver results for pending tests to follow-up providers automatically.

This work is being conducted at Wishard Memorial Hospital (WMH), a 353-bed urban public hospital on the campus of Indiana University School of Medicine. WMH uses the Regenstrief Medical Record System (RMRS) integrated with the Regenstrief-developed Gopher computerized provider order entry system. All inpatient orders and discharge summaries must be entered electronically via Gopher. The newly-developed tool will deliver pending results to providers through the Gopher system. Dr. Were and his team are using a combination of methods to discern the specific effects of each technology on processes of care.

Specific Aims:

- Develop and implement a computerized tool to automatically identify tests with pending results at hospital discharge and assist in the incorporation of these tests into the discharge summary. **(Achieved)**
- Evaluate the impact of this tool on accuracy of documenting pending tests in discharge summaries. **(Ongoing)**
- Modify an existing clinical-messaging program to enable automatic delivery of returning results for pending tests to the designated outpatient followup providers. **(Ongoing)**
- Evaluate how the automatic delivery of test results impacts followup providers' actions and attitudes. **(Upcoming)**

In addition to these specific research aims, Dr. Were, as part of the Mentored Clinical Scientist Research Career Development Award, will continue his long-term career goal of implementing and evaluating informatics-based interventions that improve quality of care and patient safety. Project funds allow him to acquire advanced skills through structured coursework, regular seminars, and mentoring with leaders in medical informatics, health services research, biostatistics, and implementation research.

2011 Activities: Dr. Were and the project team completed a randomized study to evaluate the impact of PTP on documentation of tests with pending results into hospital discharge summaries. This system is programmed to allow the Gopher system to send an HL7 trigger message to the PTP when a discharging provider signs the electronic discharge summary. Upon receiving this trigger message, the PTP identifies tests with pending results by querying the RMRS database. The tests identified through the queries are then delivered via Gopher back to the discharging provider. Data collection and analysis has been completed for 500 discharge summary reviews, each of which was reviewed by two people to ensure reliability of abstraction. The team began to develop the manuscript summarizing the study results.

Dr. Were and his team are currently modifying the PTP system and the DOCS4DOCS® tool to enable automatic delivery of returning results for pending tests to the designated outpatient followup providers, with the goal to complete by June 2012. Once the programming on the DOCS4DOCS® tool modification is complete, the team will begin the randomized controlled trial to evaluate the tool's ability to improve management of test results returning after hospital discharge.

Preliminary Impact and Findings: Manuscript preparation summarizing findings from the evaluation of the PTP tool on documentation of tests with pending results into the discharge summaries are ongoing.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Health Information Technology and Improving Medication Use

Principal Investigator:	Bates, David W., M.D., M.Sc.
Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS07-004: Centers for Education and Research on Therapeutics (CERTs) (U18)
Grant Number:	U18 HS 016970
Project Period:	September 2007 – August 2012
AHRQ Funding Amount:	\$1,999,073

Summary: The Centers for Education and Research on Therapeutics (CERTs) program is a national initiative to increase awareness of the benefits and risks of new, existing, or combined uses of therapeutics through education and research. Each CERT supports multiple research projects under the direction of a lead principal investigator.

In 2007, recognizing that health information technology (IT) has great potential to reduce medication errors and improve patient safety, the Agency for Healthcare Research and Quality funded the Brigham and Women's Hospital Health IT CERT program. The Brigham and Women's Hospital CERT-Health IT team is comprised of a methodology and data resources core and a translation and dissemination core. These cross-disciplinary cores currently support projects on soliciting information from patients on adverse medication events, using clinical decision support (CDS), evaluating new processes for medication reconciliation post-discharge, and assessing the impact of regional health information exchange on medication safety.

Results from the six CERT projects described below will break new ground in determining how current health IT-related interventions can be broadly disseminated. In addition, the Brigham and Women's Hospital CERT-Health IT team will build and bolster educational tools and programs to assist with therapeutics and health IT.

Specific Aims:

- Evaluate the impact of using telephony to ask outpatients identified from electronic health record (EHR) data if they are experiencing adverse effects related to specific medications. **(Achieved)**
- Evaluate the impact of clinical decision support and automated telephone outreach on antihypertensive and lipid-lowering therapy in ambulatory care. **(Ongoing)**
- Evaluate errors arising from implementation of electronic prescribing. **(Achieved)**
- Evaluate the impact of implementing a post-discharge ambulatory medication reconciliation intervention. **(Achieved)**
- Evaluate effects of multiple vendor-based prescribing systems on medication safety among six Regional Health Information Organizations in New York and Massachusetts. **(Achieved)**

2011 Activities: The focus of activity for each project is described below.

Project 1: e-Pharmaco-vigilance: Integrating Patient Reports of Side Effects with Electronic Health Records for Surveillance of Recently Approved Drugs. The goal of this project is to increase surveillance evidence for recently-released Food and Drug Administration-approved drugs. Interactive voice response is linked to a patient EHR to monitor patients taking these medications by calling and asking them about their progress using a medication and if they are having any problems. The project team completed the intervention in 2010 and in 2011 focused on data analysis, manuscript preparation, and dissemination.

Project 2: A Multi-Modal Intervention to Improve Antihypertensive and Lipid-Lowering Therapy. This project compares the impact of CDS with and without automated telephone outreach to patients on the use of antihypertensive and lipid-lowering medications. The team recruited one intervention site in Brockton, MA, that received EHR-based alerts, and two control sites in New York where patients will receive generic automated telephone interactive voice response (ATIVR) messages. The project conducted semi-structured informational interviews using an interview script with primary care physicians to understand care gaps in the treatment of hypertension and hyperlipidemia. The project director worked with the EHR vendor to map the CDS rules at the intervention practices, and developed a method for patient identification in a paper-based chart system at the control sites.

Project 3: Unintended Consequences of ePrescribing. This project reviewed prescriptions from commercial pharmacies to identify electronic prescription (e-prescribing) errors. The prescriptions were analyzed to determine the frequency and character of errors, and develop recommendations for preventing these errors and other unintended consequences. The team prepared for an expert panel to review unintended consequences of e-prescribing and evaluate its impact on pharmacy workflow. This panel developed a list of recommendations for preventing unintended consequences of e-prescribing. The team conducted a qualitative study of the unintended consequences of e-prescribing in the outpatient pharmacy setting, including workflow implications. A manuscript is currently being prepared.

Project 4: Ambulatory Medication Reconciliation Following Hospital Discharge. In 2007, a post-discharge medication reconciliation module was created within the ambulatory EHR to reduce medication errors. When the trial began in 2008, use of the module was low, so the project team created an active reminder (“pop up”) in the EHR medication screen and a passive reminder in the EHR summary screen. The team compared use of the reconciliation module before and after the reminders were developed. By the end of 2010, more than 1,000 clinical providers were enrolled. During the enrollment and followup period, the project team monitored the uptake of the medication reconciliation module and observed an increase in module use over time. The project team conducted a secondary analysis of the accuracy of medication lists one month after discharge compared with patient report. A manuscript describing their findings on the impact of the post-discharge ambulatory medication reconciliation intervention is being written.

Project 5: Impact of Vendor Systems on Ambulatory Medication Safety. This project compared the impact of e-prescribing by users in the short term (less than 6 months) and the longer term (greater than 1 year). The project completed enrollment of 20 providers in rural Hudson Valley, New York, and 17 providers in New York City. The team met with the commercial e-prescribing vendor to ensure that the prescription data could be captured for the time periods of interest. The team obtained electronic prescription downloads of the data from the e-prescribing vendor, and completed prescription review and data analysis. One manuscript draft has already been completed and is undergoing internal review. A second manuscript draft is being prepared.

Project 6: Identification of Decision Support Rules for Dissemination in EHRs. This project developed medication-related CDS rules for EHRs in inpatient and outpatient settings. The team reviewed a large dataset of adverse drug events involving multiple drugs in community hospitals to build on previous research and develop recommendations to prevent adverse drug events. As the second component of the project, seven sites were visited to assess the EHR and computerized physician order entry system alerts for compliance with human factors principles. The team analyzed the data collected during the seven site visits using ATLAS.ti software to identify the constructs that determine successful implementation of medication-related CDS and assessment of human factors principles. The human factors principles were developed by the research team and are established for use in other systems with visual alerts. They have not yet been applied to clinical information systems.

A 1-year no-cost extension is being used to analyze data and develop manuscripts. The project will end in August 2012.

Preliminary Impact and Findings: Preliminary findings for each project are described below.

Project 1: Pharmacovigilance provides important information related to the patient perspective. Significant differences in medication cessation were reported by patients when compared with documentation in the EHR. The project tracked the percentage of calls that triggered an email response to the provider and, for those emails, the percentage that resulted in direct follow-up through a phone call, office visit, or discontinuation of the medication. Analysis identified that pharmacovigilance is associated with increased use of specialty services but is not associated with EHR-documented medication cessation, use of acute services, death, or use of primary care services.

Project 2: An article detailing the qualitative assessment component of the study is in the final stages of manuscript preparation. Available tools from this project include an ATIVR guide and script, *Achieving Benchmarks in Treating Hypertension and Hyperlipidemia: Barriers and Best Practices*, and a detailed description and specification of quality measures and the corresponding alert triggers for the EHR alerts implemented in the intervention practice.

Project 3: Informatics strategies can be used to minimize errors, including the following: 1) CDS with maximum dose checkers; 2) automating amount to be dispensed to prevent inconsistent quantity errors by eliminating the redundant entry of the final medication quantity; and 3) use of dispense forcing functions, which create constraints in data entry to prevent errors such as structured data entry with mandatory data fields to prevent omitted information.

Project 4: If the post-discharge medication regimen is not correct in the outpatient medical record, it perpetuates the cycle of medication discrepancies. Primary care providers (PCPs) are in the best position to identify and correct errors of inpatient medication reconciliation. The electronic medication reconciliation system creates a seamless transition by explicitly involving the PCP in the post-discharge medication process.

Project 5: Support for providers before, during, and after implementation may help mitigate potential safety threats from implementation of an EHR system and result in sustained safety benefits over the long term. Relatively low error rates were found, both during implementation and during sustained use among practices with support for use of a new e-prescribing system.

Project 6: The CERT-Health IT CDS project has focused on the development of a starter set of clinically significant rules on medication-related decision support that could be implemented in clinical information systems across health care settings. These findings have been disseminated through published articles in *Health Affairs*, *BMJ Quality & Safety*, the *Journal of the American Informatics Association*, and the *Journal of Patient Safety*.

Target Population: General

Strategic Goal: Develop and disseminate health information technology (IT) evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Health Information Technology Center for Education and Research on Therapeutics

Principal Investigator:	Bates, David, M.D., M.Sc.
Organization:	Brigham and Women's Hospital
Mechanism:	RFA: HS11-004: Centers for Education and Research on Therapeutics (CERTs) (U19)
Grant Number:	U19 HS 021094
Project Period:	September 2011 - September 2016
AHRQ Funding Amount:	\$4,115,767

Summary: The Centers for Education and Research on Therapeutics (CERTs) demonstration program is a national initiative to conduct research and provide education that advances the optimal use of therapeutics (i.e., drugs, medical devices, and biological products). The program consists of six research centers and a CERTs Scientific Forum. The Health Information Technology CERT (HIT-CERT) is building on existing CERT resources and infrastructure and on the investigators' previous work related to health information technology (IT). The HIT-CERT will focus research on issues related to health IT use and impact on therapeutics. In particular, the project work involves health IT research and its translation into clinical practice for pharmacosurveillance and medication-related clinical decision support.

The HIT-CERT will address therapeutics issues related to appropriateness, safety, and efficacy in the outpatient, inpatient, and transitions in care settings within the context of health IT. Two cores—the methodology and data resources core and the translation and dissemination core—will oversee various aspects of all projects conducted within the HIT-CERT. The former core will coordinate the study for all projects by providing study design, data collection and management, and analysis support. The latter core will promote the dissemination of research findings and facilitate the translation of findings into practice and policy.

Currently, three projects are planned for HIT-CERT's 5-year duration:

1. *e-Pharmacovigilance II: Surveillance for Safety and Effectiveness.* This project will develop and implement an e-Pharmacovigilance system that integrates and interoperates with the Partners Healthcare electronic health record system. The e-Pharmacovigilance system will interface with patients either by a Web-based portal or an interactive voice response system to monitor the safety and effectiveness of treatment with Food and Drug Administration-approved medications for common chronic conditions. This project will be conducted in three phases over 5 years. Phase 1 involves the development and pilot testing of the integrated pharmacovigilance system. Phase 2 is implementation of the system. Phase 3 involves assessment of the translation and dissemination of the system using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework.

2. *Physician-Level Variation in Medication Overrides of Computerized Decision Support.* This project will assess, describe, and characterize physician-level variations in response to computerized decision-support safety issues and efficiency suggestions for both the inpatient and outpatient settings. The project will include evaluations of variation in medication overrides at baseline, followed by two cluster-

randomized trials. A set of recommendations for improving decision support system safety and efficiency will be developed based on the findings.

3. *Examining Human Factors Principles in the Design and Implementation of Medication-Related Decision Support Alerts.* This project will develop and evaluate a tool for assessing whether a medication-related decision support alert is appropriate relative to human factors principles. Over a 2-year period, an existing human factors instrument will be validated relative to override rates. Outcomes such as user's satisfaction with alerts will be assessed. Additionally, a set of recommendations on the best way to design medication alerts will be developed.

In the wake of increasing implementation and use of health IT and electronic prescribing, the HIT-CERT and its projects will provide information, strategies, and tools for utilizing health IT to improve clinical practices related to medication safety, effectiveness, and cost.

Specific Aims:

- Leverage new technologies to improve pharmacosurveillance. **(Ongoing)**
- Use new sources of data from clinical decision support to identify physician-level variation and use these results to improve safety and efficiency. **(Ongoing)**
- Improve medication-related clinical decision support. **(Ongoing)**

2011 Activities: Much of the HIT-CERT program efforts in 2011 focused on project start-up. All three projects have received approval from the Brigham and Women's Hospital's Institutional Review Board. Project development activities for each project are in progress and data collection will be initiated in 2012.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Chronic Care*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Tools for Optimizing Medication Safety (TOP-MEDS)

Principal Investigator:	Lambert, Bruce, Ph.D., M.A.
Organization:	University of Illinois at Chicago
Mechanism:	RFA: HS11-004: Centers for Education and Research on Therapeutics (CERTs) (U19)
Grant Number:	U19 HS 021093
Project Period:	September 2011 - September 2016
AHRQ Funding Amount:	\$711,643

Summary: The Centers for Education and Research on Therapeutics (CERTs) demonstration program is a national initiative to conduct research and provide education to advance the optimal use of therapeutics such as drugs, medical devices, and biological products. The program consists of six research centers and a CERTs Scientific Forum, and is funded and run as a cooperative agreement by the Agency for Healthcare Research and Quality (AHRQ), in consultation with the U.S. Food and Drug Administration (FDA).

Drug therapy is the most common medical service patients receive, but it is plagued by risks and hazards. The need for solutions that can prevent or mitigate medication-related harm is critical. Newly released medications may cause unusual side effects in patients that were not identified in pre-marketing research. High-risk commonly used drugs such as opioid analgesics are frequently selected and dosed improperly. Drug name confusion causes patients to receive the wrong drugs. Consumers use drugs unsafely because drug information is limited and/or confusing. Therefore, this project is developing Tools for Optimizing Medication Safety (TOP-MEDS). The project is developing, testing, deploying, and disseminating tools and training materials in four key areas: 1) statistical methods for large-scale studies of comparative drug safety and effectiveness; 2) opioid prescribing and dosing for acute pain; 3) methods for preventing and detecting drug name confusion errors; and 4) patient-centered, language concordant drug information.

Research findings will be disseminated through a network of cooperating organizations with local and national reach. To achieve its educational objectives, the TOP-MEDS CERT will emphasize education in two of its four aims by engaging in broad outreach activities at conferences for health professionals; developing Web-based training programs for in-house staff; creating continuing education programs; producing Web-based content related to the four key areas; and using social media—especially Facebook, Twitter, and YouTube—to disseminate their work. Project staff will also work with payors, accreditors, policymakers, and legislators to identify policy levers that can increase the adoption of patient-safety best practices.

Specific Aims:

- Develop and apply a multivariate person-time logistic regression model for large-scale adverse drug event screening. **(Ongoing)**
- Improve the safety and effectiveness of inpatient acute pain care by developing and validating a Web-based simulator to train prescribers in the proper selection and dosing of opioids. **(Ongoing)**
- Refine a standard battery of tests for pre-market safety screening of drug names, and develop and test

methods for preventing and detecting drug name confusion errors in clinical databases. **(Ongoing)**

- Evaluate an electronic health care-based, low-literacy strategy for promoting safe, effective prescription drug use among English and Spanish-speaking patients in an urban primary care setting. **(Ongoing)**

2011 Activities: The project began during the last quarter of 2011 and is in the start-up phase. Because each aim represents a distinct research project, activities are listed by aim:

First aim: The study team is working to establish contracts, organize regular meetings, and develop and refine methods.

Second aim: The primary work has been on refining the scientific protocol for the institutional review board (IRB) to develop the measurement strategy in the inpatient setting.

Third aim: The development of the analytic methods and the battery of tests to identify which drug names are confusing were initiated. Subcontracts were executed and IRB approval was obtained.

Fourth aim: The IRB protocol is complete and will be submitted. The study staff is clarifying components of this aim for AHRQ.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Low Literacy, Low-SES/Low Income*, Racial or Ethnic Minorities*: African-American, Hispanics

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Improving the Quality of Pediatric Emergency Care Using an Electronic Medical Record Registry and Clinician Feedback

Principal Investigator:	Alpern, Elizabeth, M.D., M.S.C.E.
Organization:	The Children's Hospital of Philadelphia
Mechanism:	PA: HS09-070: AHRQ Health Services Research Projects (R01)
Grant Number:	R01 HS 020270
Project Period:	September 2011 - September 2016
AHRQ Funding Amount:	\$491,419

Summary: Emergency departments (EDs) routinely collect substantial patient data that have the potential to provide information on the quality of care provided to acutely ill and injured children. The capacity to capture and analyze these data, however, is limited. The increasing use of electronic health records (EHRs) in EDs provides an opportunity to access patient clinical data, and efficiently track and evaluate quality of care, performance measures, and patient outcome measures. EHRs also hold the potential for developing patient registries using electronic abstraction instead of the resource and labor-intensive manual chart abstraction required with paper records. Abstracting data in an automated way from EHRs could make it possible to evaluate the quality of patient care, assess health care costs, and ultimately reduce the incidence of adverse events. Using the novel health information technology (IT) application of natural language processing (NLP), clinical data can be extracted from discrete and free-text fields of an EHR.

This project is developing a registry to collect and report quality measures of emergency care provided to children. To do this, a multi-stage process will be used to: 1) develop an emergency care visit registry for pediatric patients using EHR clinical data; 2) report performance measure outcomes by ED site and by individual clinicians; and 3) evaluate whether providing performance measure feedback to sites and clinicians improves performance and decreases variation between sites and clinicians. This project uses the infrastructure of the Pediatric Emergency Care Applied Research Network (PECARN), which was established in 2001 as a federally-funded national network for research on pediatric emergencies and emergency medical services for children. The emergency care visit data registry for pediatric patients will be known as the PECARN Registry.

During Stage I of this project, the PECARN Registry will be developed by merging data from four hospitals within the network. A test data transfer will allow each site to upload data for a 1-month period from the preceding calendar year. This will allow testing and evaluation of the database and data upload, the NLP algorithm derivation, the merging process, and the quality assurance process. After completing the test data transfer, electronic data on all pediatric ED patients from each site from the prior calendar year will be transmitted to a central data coordinating center. Subsequently, data will be uploaded monthly from each site for a period of 18 months, providing 2.5 years of data in total and representing approximately 1,040,000 pediatric ED visits.

During Stage II of this project, the Registry will be used to collect and report on 14 performance measures. Ideal benchmarks of care for each performance measure will be determined by using the Achievable Benchmarks of Care method and by convening an expert panel. The benchmarks of care

will gauge the performance measure outcomes. Quality performance measure report cards (hereafter, report cards) will be developed for ED sites and for individual clinicians at each site. The site-level report cards will contain outcomes for all 14 performance measures, and the corresponding benchmarks will be noted. The clinician-level report cards will include individual clinician outcomes on five of the fourteen performance measures. The five clinician-level performance measures are within the locus of control of the individual clinicians and amenable to physician behavior change.

In Stage III of this project, the clinician and site report cards will be generated and distributed on a monthly basis. The site-level report cards will include the performance measure outcome results from the other sites as a comparison. A time-series trial will assess whether the clinician feedback results in improvements in the performance measures themselves, as well as if they decrease variation in performance across clinicians.

The goal of this project is to provide decisionmakers with a tool to track, report, and improve the quality of emergency care for children within and across sites of care.

Specific Aims:

- Develop an emergency care visit registry for pediatric patients. **(Ongoing)**
- Use this registry to collect stakeholder-prioritized emergency care performance measures for important pediatric medical and trauma conditions at the level of both the ED and individual clinician. **(Upcoming)**
- Use this registry to report performance to individual ED clinicians. **(Upcoming)**

2011 Activities: Activities to date have involved project start-up and development work. All project personnel have been hired. Protocol development is in process and is nearing completion for institutional review board submission. Development of the registry has been initiated by mapping variables from the EHR that will be included.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

* This target population is one of AHRQ's priority populations.

Computer Automated Developmental Surveillance and Screening

Principal Investigator:	Carroll, Aaron, M.D., M.S.
Organization:	Indiana University- Purdue University at Indianapolis
Mechanism:	PA: HS07-243: AHRQ Health Services Research (R01)
Grant Number:	R01 HS 017939
Project Period:	June 2009 – May 2012
AHRQ Funding Amount:	\$899,183

Summary: Developmental disabilities affect between 12 and 16 percent of the pediatric population in the United States. “Best practices” guidelines require that children receive appropriate and timely screening and treatment for these disabilities. Electronic computer decision support strategies offer a promising aid for implementing a standardized approach to developmental surveillance and screening.

Prior to this grant, researchers at Indiana University developed an electronic computer decision support system for pediatric practices called CHICA – Child Health Improvement Through Computer Automation – to deliver appropriate guidelines to physicians during patient visits. CHICA was modified to incorporate developmental surveillance and screening within the existing practice workflow without requiring additional time of the physician or other office staff. The CHICA system includes: 1) pediatric guidelines encoded in Arden Syntax, a common computer language representing medical conditions and recommendations; 2) a dynamic scan form interface for the user; and 3) a Health Level 7-compliant interface to existing medical record systems.

This project extends the CHICA software by incorporating the 2006 American Academy of Pediatrics (AAP) guidelines into the surveillance and screening algorithm, and evaluates the effect of the CHICA system on developmental surveillance, screening, referral, and early intervention and early childhood services. This evaluation follows a cohort of children with developmental disabilities to compare the proportion of children who undergo developmental screening at 9-, 18-, and 30-month visits at four practice sites, two of which have implemented the CHICA system and two of which have not. This evaluation will identify how implementation of the AAP recommendations into CHICA affects adherence to clinical guidelines. In addition, documentation of long-term outcomes will contribute to knowledge about the impact of early surveillance and screening on child health. Qualitative aspects of child screening surveillance will also be explored. These include elements of the child’s management plan such as family involvement in treatment decisions and planning, treatment that is based on the initial assessment versus treatment that is continuously modified using data-driven decisionmaking, and whether management strategies build on the strengths of the child.

Specific Aims:

- Expand and modify an existing computer-based decision support system (CHICA) to include the 2006 AAP developmental surveillance and screening algorithm. **(Achieved)**
- Evaluate the effect of the CHICA system on the developmental surveillance and screening practices of four pediatric clinics. **(Ongoing)**

- Evaluate the effect of the CHICA system on referrals for developmental and medical evaluations, and for early developmental intervention and early childhood services. **(Ongoing)**
- Develop and follow a cohort of children with identified developmental disabilities to look at the end results and effects of developmental screening. **(Upcoming)**

2011 Activities: The project intervention including the implementation of the Ages and Stages Questionnaire to identify developmental concerns, display of data for physicians, and tracking of screened patients within CHICA is fully implemented. The team completed all the baseline evaluations of developmental screenings and is reviewing the second and third rounds of screenings. The data collection phase included a chart review at intervention practices to identify rates of diagnosis and referral for services. At the control practices, chart reviews identified referrals as well as developmental screening rates. Because developmental screening is universal at three different stages in life, this study may be powered to look at secondary outcomes such as the rates of confirmation, diagnosis, and intervention.

At the end of 2011, the research team was working on the recruitment of children and their parents to follow as a cohort and evaluate the effects of developmental screening. This recruitment process will continue in 2012. Training of research assistants who will be surveying parents was completed, and in 2012, the research team plans to recruit 20 parents per clinic.

As part of the evaluation, CHICA assembled a report card for physicians to provide feedback on their assessment and management of patients with developmental disorders. In 2011, these scorecards were distributed on a periodic basis to allow multiple rounds of feedback. Providers discuss CHICA general issues on what is working well and what needs to be improved at regularly held meetings. By sharing the feedback reports at these meetings, the research team and providers can discuss what each report says. Currently, the reports are designed to be part of the research process only.

Preliminary Impact and Findings: The team originally planned auto scanning and scoring of the Autism Screening Questionnaire but found that providers prefer to score the screening tool themselves. Qualitatively, they have been looking at the factors that contribute to use of the CHICA system, such as practice type and provider characteristics. In general they are finding that younger physicians are quicker to adopt the system. As part of the research process, the research team proposed CHICA provider user groups as a mechanism to field requests for changes to the system. Recently, the principal investigator decided to select a group of more engaged pediatricians to meet once a month separately from the original provider group. They are able to engage these pediatricians in a more informed way and receive substantive feedback on how to improve CHICA.

Target Population: Pediatric*: Age 0-5, Children with Special Health Care Needs

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Improving Population Health Through Enhanced Targeted Regional Decision Support

Principal Investigator:	Grannis, Shaun, M.D., M.S.
Organization:	Regenstrief Institute
Mechanism:	PA: HS09-070: AHRQ Health Services Research Projects (R01)
Grant Number:	R01 HS 020909
Project Period:	September 2011 - September 2016
AHRQ Funding Amount:	\$2,041,559

Summary: Clinical providers often underreport population-level disease burden or their reporting is incomplete, inaccurate, or delayed. A variety of reasons cause this, including: 1) a lack of knowledge on reporting requirements and process; 2) a lack of resources to facilitate the reporting process; and 3) a perceived lack of value for reporting. Underreporting and incomplete reporting can lead to inaccurate assessments of the disease burden in a community, which hinders population health interventions and preventive care delivered to individual patients.

As clinical data is captured increasingly in electronic form, there is potential for more comprehensive assessment of disease burden and increased automation of electronic public health reporting. Health information exchanges (HIEs) are an emerging source of health care and clinical data that can be used to facilitate information-sharing and data quality. An automated electronic laboratory reporting system that leverages data from an integrated HIE can overcome some of the disease burden reporting limitations by enhancing population-based reporting with additional data such as recent laboratory results, enhanced patient and provider demographics, and medication history.

In an effort to improve clinician reporting of notifiable conditions to public health, and to improve the quality of the data collected, this project is implementing novel clinical decision support and clinical messaging tools. The research team will develop a standard pre-populated case reporting form to serve as a clinical decision support tool containing patient demographic data and pertinent case management information. The form will remind clinicians to report notifiable cases to the appropriate public health stakeholders and will provide guidance on the reporting information needed. A clinical messaging system will deliver the forms, allowing them to be integrated more seamlessly into health care providers' workflow. The clinical messaging system will build on an existing HIE known as the Indiana Network for Patient Care (INPC). When forms are flagged as reportable, they will be sent to appropriate clinical providers and public health agencies and submitted to the INPC. An interrupted time series design will be used to evaluate the effects of the standard pre-populated form reminder intervention on a variety of outcomes, including the rate of provider reporting, data quality, and timeliness of reporting to public health officials.

An enhanced pre-populated form that includes supplemental clinical case data will also be developed and deployed. A group of public health stakeholders will determine which supplemental data elements are needed for a select set of reportable conditions. The research team will evaluate the quality and feasibility of the supplemental data. The enhanced pre-populated form will be compared to both pre-intervention data and the standard pre-populated form on various outcomes.

Lastly, the research team will administer a series of interviews throughout the research project to collect qualitative data from clinicians and public health stakeholders to identify factors that influence the impact of the tools on workflow, provider awareness, and user satisfaction.

The implementation of automated data capture and information enhancements will streamline the reporting workflow for notifiable conditions, lower barriers to reporting and case followup, increase data completeness, and capture a greater portion of communicable disease burden.

Specific Aims:

- Evaluate the process and operational outcomes of deploying an advanced technical framework and methodology in the context of a long-standing operational HIE that enhances management of population-level notifiable condition reporting and bidirectional communication among providers and population health stakeholders using decision support tools. **(Ongoing)**
- Evaluate the quality of existing health care data and the capacity of an advanced technical framework to enhance data quality by measuring baseline, pre-implementation and post-implementation data quality statistics including accuracy, completeness, and timeliness for provider and patient demographic information, and additional relevant clinical data. **(Upcoming)**
- Identify and assess facilitators and barriers – including social, behavioral, and environmental – that are associated with the implementation and utilization of an advanced technical framework both within single organizations and across multiple organizations within an HIE. **(Ongoing)**

2011 Activities: This project was initiated in the fourth quarter of 2011 and activities primarily involved project start-up. Institutional review board applications were submitted and are pending approval. Development of data collection and analysis plans is in process, along with clinic recruitment strategies, including outreach to clinic directors and coordinating clinic site visits. Planning for the project kick-off meeting occurred and the meeting for all co-investigators and research staff will be held in early 2012. Lastly, a technical project plan to activate the prototype electronic forms generation process was developed and will be validated in early 2012.

As last self-reported in the AHRQ Research Reporting System, project progress and activities are on track and the project budget funds are somewhat underspent. Once subcontracts are executed, project budget spending will be on track.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Table 13: One Time Request for Proposal Contracts

One-Time Requests for Proposals				
Completed in 2011	Principal Investigator	Project Title	Contract Number	Page of Summary
State and Regional Demonstrations in Health Information Technology (SRDs)				
Yes	Lee, Jan, MD	Delaware Health Information Network	290-05-0012	347
Yes	Root, Jan, PhD	Improving Communications Between Health Care Providers via a Statewide Infrastructure: Utah Health Information Network Clinical State and Regional Demonstration Project	290-04-0002	349
Yes	Zimmerman, Amy, MPH	Rhode Island Statewide Health Information Exchange—State and Regional Demonstration Project, currentcare	290-04-0007	351
Clinical Decision Support Initiative				
No	Middleton, Blackford, MD, MPH, MSc	Clinical Decision Support Consortium	290-08-10010	353
No	Shiffman, Richard N., MD, MCIS	Guidelines Into Decision Support	290-08-10011	356

Delaware Health Information Network

Principal Investigator:	Lee, Jan, M.D.
Organization:	State of Delaware
Contract Number:	290-05-0012
Project Period:	September 2005 – September 2011
AHRQ Funding Amount:	\$4,700,000

Summary: The Delaware Health Information Network (DHIN), a public-private partnership that received Agency for Healthcare Research and Quality (AHRQ) funding in September 2005, implemented a real-time electronic method for health care providers to obtain information about their patients. This project is one of six AHRQ-sponsored State and Regional demonstration projects that began in late 2004 and early 2005 to create a State or regional health information exchange (HIE).

The DHIN exchanges data among hospitals, reference laboratories, physician practices, and public health agencies through the State. Partners include consumers, physicians, hospitals, businesses, payers, government agencies engaged in health care, and reference laboratories.

The DHIN board of directors is comprised of diverse organizations representing the primary stakeholders of the HIE. They include consumers, physicians, hospitals, health plans, business, higher education, and State government agencies responsible for population health and information technology.

Project Objectives:

- Improve care of patients served by Delaware's health care system, and reduce medical errors associated with inaccurate or incomplete information available to providers. **(Achieved)**
- Reduce the time and financial costs of HIE by reducing the complexity of current distribution methods and increasing use of electronic means. **(Achieved)**
- Improve communication between health care providers and patients to provide appropriate, timely care that is based on the best available information. **(Achieved)**
- Reduce the number of duplicative tests and expedite the reporting of consultant opinions and tests/treatments between specialists and the referring physicians. **(Achieved)**
- Improve the efficiency and value of electronic health record (EHR) systems in physicians' offices, and assist physicians that do not have an EHR to better organize and retrieve test results. **(Achieved)**

2011 Activities: Due to delays in previous years of the contract, the contract was extended by 12 months which extended the project period until September 2011. Activities during this period focused on continued support of DHIN functions as well as collection of data and project evaluation.

Impact and Findings: Through implementation of technology, commitment of hospitals and reference laboratories that submit results data to the DHIN, and systematic enrollment of providers, DHIN established the infrastructure and data penetration required to carry out the objectives of this project. The reach of the project is significant and has included 75 percent of Delaware hospitals and all major reference laboratories that provide results data to over 435 provider practices with multiple users. Slightly

more than 533,000 results were submitted to the DHIN from hospitals and reference labs, and more than 578,000 results were distributed to providers. This represents an increase over the same period 1 year earlier, an increase of about 15 percent in results submitted, and an increase of about 50 percent in results sent. As of June 30, 2011, there were more than 1 million unique patients in the database.

Both the quantitative and qualitative measures demonstrated that while DHIN continues to push data to providers, those same providers are retrieving data from the DHIN at increasing rates. End users interviewed indicated that using the DHIN information was a consistent part of their workflow. Provider use of the DHIN to access information on patients presenting for treatment where a prior clinical relationship was not established in the DHIN increased ten-fold. This data, combined with interview information, demonstrates the DHIN is searched for results and reports to support effective and efficient care. Among health care providers interviewed, there was consensus that data provided in the DHIN will have an impact on care delivery including reduction in duplicate tests. This was supported with an analysis of results for tests that are often high cost and high volume. The rate of test results per unique patient sent through the DHIN in June 2011 as compared to June of 2009 was 30 percent lower for radiology exams and 33 percent lower for lab results.

DHIN has also had an effect on cost for both providers and data senders beyond those recognized from workflow improvements related to patient care. Compared to the average cost to send results using traditional methods of fax and mail, data senders serving providers who utilize the DHIN as the primary method for receiving results have saved more than 2 million dollars. Additional savings of 1 million dollars could have been realized for the same period if all DHIN member providers were committed to use the DHIN as their primary source of results reporting. By comparing the cost to interface via point to point methodology versus through the DHIN, an estimated implementation cost savings of between \$18,500 and \$28,500 can be realized by each provider practice.

Finally, several lessons were identified from the project evaluation. The focus of the lessons is closely related to measuring and delivering value from the HIE and they include:

- Organizations should plan for measurement from the beginning of the initiative.
- Organizations should continue to measure on an ongoing basis.
- Processes must be implemented to secure provider sign-off.
- The sender bears the responsibility for providing clean and useable patient data. A standardized nomenclature or identifier for tests and procedures should be established.
- The value of the HIE increases exponentially when providers interface the data to their ambulatory electronic health records.

Target Population: General

Strategic Goal: To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Improving Communications Between Health Care Providers via a Statewide Infrastructure: Utah Health Information Network Clinical State and Regional Demonstration Project

Principal Investigator:	Root, Jan, Ph.D.
Organization:	Utah Health Information Network
Contract Number:	290-04-0002
Project Period:	September 2004 – September 2011
AHRQ Funding Amount:	\$5,000,000

Summary: The Utah Health Information Network (UHIN) is one of six Agency for Healthcare Research and Quality (AHRQ)-sponsored State and Regional demonstration projects begun in late 2004 and early 2005 to create a State or regional health information exchange (HIE). UHIN is a coalition of health care insurers, physicians, hospitals, laboratories, local health departments, health centers, State agencies, and other interested parties that have come together to reduce health care costs and improve the quality of care through the use of electronic data interchange.

UHIN's goal was to implement statewide information and communication technologies to facilitate the exchange of clinical data among its members. The first 4 years of the UHIN project were dedicated to building coalitions, developing infrastructure, identifying and engaging in dialogue amongst disparate UHIN partners, developing self-governance policies and procedures, and determining technological and administrative requirements needed to support the HIE. The enhanced infrastructure, which allows initial exchange of clinical information through UHIN, is a utility for direct entry of claims, eligibility inquiries, and other health care transactions. In 2009, UHIN contracted with the Axolotl Corporation to develop a comprehensive solution for clinical information exchange to form the technical infrastructure for the clinical health information exchange (cHIE). This change in direction led to delays in the overall implementation of the HIE and evaluation plans, though the primary objectives remained intact. UHIN eventually adopted a formative evaluation format in order to inform and track the development of the HIE.

This project has played a significant role to update the UHIN system infrastructure to be able to exchange clinical data. With the pilot complete, the ultimate goal will be to enable UHIN to become the statewide Veteran's Affairs (VA) exchange in 2012.

Project Objectives:

- Develop a novel exchange of laboratory and prescription drug data among unrelated entities. **(Achieved)**
- Conduct analyses of the role of the Medicaid program. **(Achieved)**
- Provide an evaluation of the project. **(Achieved)**
- Implement a sustainability model. **(Achieved)**
- Community implementation of clinical data exchange utilizing the expanded cHIE infrastructure that includes an "Electronic Medical Record Lite," a master patient index, and virtual health records-query functionality. **(Achieved)**

2011 Activities: The focus of activity was on continuing to work with the VA to exchange continuity of care documentation between the VA and rural hospitals in Utah by connecting UHIN to the Nationwide Health Information Network. Completion of the pilot and evaluation helped to inform the impact that cHIE can have on workflow and adoption. Most of the evaluation participants had completed an initial baseline workflow analysis prior to their participation in the cHIE, however, the contract was extended by 12 months to allow UHIN to complete the evaluation. This project was completed September 2011.

Impact and Findings: Utah has relatively high electronic health record (EHR) penetration, especially in larger clinics. Many providers have already interfaced their EHRs with hospitals and laboratories, or are in the process of doing so. UHIN used a portion of the project funding to launch a successful grant program for connecting EHRs to the cHIE. Given Utah's high-EHR-penetration environment, this proved to be an effective strategy to increase connectivity rates.

At the completion of the project's funding period, 13 facilities, including 11 hospitals, one large clinic group, and one independent laboratory, had sent more than 8 million clinical messages to the HIE. While the impact of the use of cHIE by clinicians on patient safety and quality of care could not be measured due to its early stages, interviews completed with both clinics and hospitals indicated that despite initial delays in implementation, enthusiasm and expectations for the cHIE remain high.

One of the important lessons learned in the course of the project is that evaluation of outcomes should not wait until HIE is fully mature and functioning and widely used. Rather, outcomes should be measured on an ongoing basis, to the extent possible, while recognizing and acknowledging the potential limitations of such an approach.

Target Population: General

Strategic Goal: To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Rhode Island Statewide Health Information Exchange, *currentcare*

Principal Investigator:	Zimmerman, Amy, M.P.H.
Organization:	Rhode Island Department of Health
Contract Number:	290-04-0007
Project Period:	September 2004 – June 2011
AHRQ Funding Amount:	\$5,000,000

Summary: The Rhode Island Statewide Health Information Exchange (HIE), known as *currentcare*, is one of six Agency for Healthcare Research and Quality (AHRQ)-sponsored State and Regional Demonstration projects initiated in 2004 and 2005 to create HIEs. *Currentcare* was created via the collaboration of the Rhode Island (RI) Department of Health (HEALTH), the Rhode Island Quality Institute (RIQI), and stakeholders across the State. This project developed the capability in RI to deploy health information infrastructure on a statewide scale.

RIQI's role in the project was to determine the governance for the project, while HEALTH's role was focused on the project management aspects of building and deploying the HIE. It was planned from the onset that once the HIE was operational, it would be managed and maintained outside State government. The project team directly engaged the broader community throughout the project to be involved with the formulation of policies and the design of the technical infrastructure.

The project had a unique challenge because the RI HIE Act of 2008 contained stricter privacy and confidentiality protections than other State and Federal health information privacy laws. This led to a great deal of work on the part of RIQI, HEALTH, and the larger community to ensure compliance with those laws. The decision to engage the larger community, while positive, created its own challenges. The project team experienced delays in system development from complexities in administrative, technical, policy processes, and the challenges of consensus building. As a result, there was a delay in generating value from the HIE and a postponement of when the project will become self-sustainable.

Enrollment efforts initially targeted Medicaid beneficiaries and were expanded to include patients at the site of care and in long-term care facilities. By the end of the project, more than 150,000 patients had been enrolled in *currentcare*. Major project successes included the development of policy, the passage of HIE legal protections, and consumer engagement, all of which exceeded community expectations. It is hoped that the project's contribution to the HIE body of knowledge will be used to emphasize the need to understand and actively manage the complex relationship between the propensity for change in social and health systems and the conditions required for acceptance of technology as a tool for progress in a given community.

Project Objectives:

- Improve the quality, safety, and value of health care in the State of Rhode Island through a sustainable statewide HIE system. **(Ongoing)**
- Incorporate a master patient index (MPI) into the HIE to locate longitudinal patient health information

from numerous data-submitting partners statewide. Design the HIE so that consumers will be allowed to control access to their data. **(Achieved)**

- Implement the capability to present data from various sources in an integrated, patient-centric manner using a common user interface. **(Achieved)**
- Transition all operating, management, and governance responsibility of the HIE to a community-based regional health information organization. **(Achieved)**

2011 Activities: The focus of activity during 2011 was on completing the acceptance testing phase and security audit and launching the pilot implementation. In early 2011, the data submitting partner agreements were executed by a large regional laboratory, an independent hospital, and one of the State's largest integrated delivery networks. Live laboratory data began flowing into *currentcare* on April 5, 2011. As of the end of AHRQ contract in June 2011, *currentcare* enrollment exceeded 150,000 consumers, approximately 15 percent of the State's population.

The overall timeline of the project was extended because unprecedented floods in Rhode Island in 2010 completely destroyed the data center that housed *currentcare*. The contract was extended for 1 year to allow time to replace hardware and recover software. Once the replacement data center was operational, the acceptance testing continued and overall progress resumed. The project was completed in June 2011.

Impact and Findings: This project was subjected to several unanticipated and significant schedule delays and, as such, did not deliver a fully functioning HIE solution in time to measure and report the impact on health outcomes. However, the project successfully developed the capability to deploy health information via an HIE infrastructure across the State. Notable results included: 1) the development of a comprehensive HIE policy framework; 2) the passage of State law; 3) promulgation of regulations to ensure patient privacy safeguards; 4) demonstration of a consumer-driven consent model with implementation of a participation service to broker consented data sharing; and 5) a "leveraged infrastructure" model that dovetails with current HIE trends.

The physical infrastructure and the policy, legal, and operational framework derived from the project are being used to augment the practice of medicine in the State. Future research will help generate answers to essential strategic questions pertaining to the value proposition for electronic HIE.

Target Population: General

Strategic Goal: To develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Implementation and Use

Clinical Decision Support Consortium

Principal Investigator:	Middleton, Blackford, M.D., M.P.H., M.Sc.
Organization:	Brigham and Women's Hospital
Contract Number:	290-2008-10010
Project Period:	March 2008 – July 2013
AHRQ Funding Amount:	\$6,250,000

Summary: Despite evidence of the effectiveness of clinical decision support (CDS), only a small number of academic medical centers and integrated delivery networks account for the majority of CDS research and development. Wider CDS adoption has been limited by a variety of social, political, psychological, economic, and technical issues. These include: 1) a lack of widely adopted standards for representing and sharing clinical knowledge in a computable form; 2) difficulty developing clinical practice guidelines that can be readily and unambiguously translated into a computable form; 3) absence of a central repository or knowledge resource where computable guidelines can be stored and shared; 4) challenges integrating CDS into clinical workflow; and 5) limited understanding of organizational and social issues relating to CDS.

As demonstrated at sites where CDS is pervasive, these barriers are surmountable. The biggest challenges to widespread CDS adoption include the complexity of the CDS; a lack of understanding of how to create the initial building blocks; identifying costs; and identifying the process for maintaining an up-to-date CDS. To address these challenges, investigators from Brigham and Women's Hospital, Harvard Medical School, and Partners HealthCare Systems (PHS) formed the CDS Consortium in collaboration with 24 organizations across the United States, including vendors, health care organizations, and academic institutions.

The goal of the CDS Consortium is to assess, define, demonstrate, and evaluate best practices for knowledge management (KM) and CDS in health information technology (IT) across multiple ambulatory care settings and electronic health record (EHR) technology platforms in pursuit of widespread CDS adoption. The CDS Consortium is developing a series of service-oriented CDS interventions focused on diabetes, coronary artery disease, and hypertension screening. In the first 2 years of the project, the team developed the service-oriented CDS interventions and piloted them in four ambulatory sites in Massachusetts. Currently, the team is expanding the interventions and continues to gather data and develop best practices.

Project Objectives:

- Assess and define best practices for knowledge management and CDS in ambulatory care. **(Ongoing)**
- Define a novel, practical knowledge representation scheme that allows users to access knowledge in a manner that facilitates the translation of knowledge into CDS within EHRs. **(Ongoing)**
- Build a prototype national knowledge repository to support access and use of knowledge artifacts and collaborative knowledge engineering. **(Achieved)**
- Build publicly-available cloud-based Web services to provide remote CDS. **(Achieved)**
- Build end-user CDS dashboards that would depict user's compliance with CDS and provide feedback to knowledge engineers on the efficacy of the CDS. **(Achieved)**
- Coordinate overall CDS Consortium evaluation activities. **(Ongoing)**

- Demonstrate the feasibility of a service oriented architecture-based approach through multi-site, multivendor demonstration projects. **(Ongoing)**
- Disseminate results through a variety of traditional channels. **(Ongoing)**

2011 Activities: The CDS Consortium continued to pursue research and development, completing a series of deliverables including but not limited to: 1) a 6-month trial of Enterprise Clinical Rules Service with Regenstrief Institute's CareWeb and PHS's Longitudinal Medical Record; 2) the initiation of the development of the dashboard prototypes using one of the OpenSource Dashboard programs; 3) publication of Structured Care Recommendations content on the CDS Consortium KM Portal; and 4) publication of the Advancing CDS project content. In addition, the CDS Consortium continued work with Next Gen and GE to implement cloud-based CDS into their EHR products.

Other work in 2011 included: 1) the development of a novel method for CDS performance assessment; 2) the development of a robust clinical content governance and editorial process; 3) the development of a legal framework to support the CDS Consortium activities; and 4) the development of the first prototype of the Knowledge Authoring Tool (CDSC-KAT) for creating knowledge artifacts at Level 3.

Dissemination activities in 2011 included a presentation of CDS progress and participation in a series of demonstration meetings with EHR and clinical content vendors at the American Medical Informatics Association (AMIA) annual symposium in October, and the annual Healthcare Information and Management Systems Society Meeting in February. The CDS Consortium also published six journal articles and three conference papers in 2011. These include a [paper](#), published in the December 2011 volume of the *Journal of the American Medical Informatics Association*, describing a multi-layered knowledge representation framework for structuring guideline recommendations for implementation in a variety of CDS contexts. In addition, a [paper](#) describing a legal framework for developing agreements in support of sharing, accessing, and publishing content via the KM Portal, was presented at the 2011 AMIA symposium and received a Distinguished Paper nomination. The full list of publications is available on the [CDS Web site](#).

Preliminary Impact and Findings: The CDS Consortium has solved critical technical challenges for sharing CDS, developed social and legal frameworks and model contracts to facilitate such sharing and, most critically, built a trusting community of CDS researchers, developers, and clinical information system vendors who are willing and ready to share their knowledge and expertise. This work has brought the CDS Consortium and the United States CDS community much closer to the Consortium's ultimate goal to assess, define, demonstrate, and evaluate best practices for KM and CDS in health care information technology at scale across multiple ambulatory care settings and EHR technology platforms.

In its 3 1/2 years, the CDS Consortium matured significantly, as demonstrated by increasing collaboration with outside parties, such as EHR and content vendors, that initially were reluctant to join. The CDS Consortium also showed, for the first time, that their services could work external to PHS. This index case sets the stage for a much broader and more rapid rollout of CDS services across multiple ambulatory care settings and EHR technology platforms. The research also indicated that a sound legal foundation was required for knowledge sharing and CDS services in order to address data sharing, intellectual property, accountability, and liability concerns. Therefore, the team developed a set of clinical content editorial and governance procedures, and a legal framework with component legal agreements to make the CDS resource useful.

Target Population: Adults, Chronic Care*, Coronary Artery Disease, Diabetes, Hypertension

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

**This target population is one of AHRQ's priority populations.*

Guidelines into Decision Support

Principal Investigator:	Shiffman, Richard N., M.D., M.C.I.S.
Organization:	Yale University
Contract Number:	290-08-10011-20
Project Period:	March 2008 – April 2012
AHRQ Funding Amount:	\$2,500,000

Summary: The Guidelines into Decision Support (GLIDES) project supports the development, implementation, and evaluation of demonstrations that advance the understanding of how to incorporate computerized clinical decision support (CDS) into health care delivery at ambulatory care sites. A centerpiece of the GLIDES strategy is the Guideline Elements Model (GEM). GEM is a knowledge model for guideline documents that incorporates a set of more than 100 tags to categorize guideline content. The overall goal of the project is to recommend methods to assist clinical organizations across the country with the efficient and effective implementation of CDS. GEM provides a bridge between the process of knowledge discovery and synthesis and CDS implementation, and forms the backbone of tools that translate narrative guidelines into structured knowledge that can be implemented consistently. A combination of quantitative and qualitative evaluation methods are being used to determine the project's results and major findings.

GLIDES is led by Dr. Shiffman and staff from the Yale School of Medicine's Department of Pediatrics and the Center for Medical Informatics, and is assisted by clinical and information technology (IT) staff from Yale New Haven Hospital. Yale's implementation partners include The Children's Hospital of Philadelphia, Geisinger, and Alliance of Chicago. The GLIDES team also collaborates with a number of guideline developers including the American Academy of Pediatrics, the American Academy of Otolaryngology, the American Urological Association, and the American Society for Clinical Oncology.

The GLIDES project team is exploring the possibility of providing GEM-parsed content to the National Guidelines Clearinghouse. To date, GLIDES CDS demonstration tools have been integrated at selected primary and specialty clinics within the Yale New Haven collaborators' systems.

Project Objectives:

- Implement evidence-based guideline recommendations that address prevention of pediatric obesity and chronic management of asthma. **(Achieved)**
- Apply the GEM and associated tools that facilitate the development of executable code to systematically and replicably transform the knowledge contained in these guidelines into a computable format. **(Achieved)**
- Deliver the knowledge via CDS to ambulatory sites that employ the Centricity electronic health record (EHR) at Yale and EpicCare EHR at Nemours. **(Achieved)**
- Evaluate the fulfillment of these goals and the effectiveness of the decision support tools in improving the quality of health care. **(Achieved)**
- Disseminate the findings and lessons learned via a variety of modalities. **(Ongoing)**

2011 Activities: After many of the initial project objectives were achieved, the GLIDES team established additional objectives to be completed in a 12-month no-cost extension period. These are: 1) use systematic and replicable processes; 2) continue to design, develop, implement, and demonstrate guideline-based CDS; 3) focus on new guidelines and implementation partnerships; 4) enhance and improve the CDS already produced at Yale and Nemours; 5) recognize the critical importance of transparently developed and clearly stated guideline recommendations for effective implementation and work closely with guideline developers to provide tools and guidance to improve guideline development and reporting processes; 6) update the GEM and increase GEM adoption nationally and internationally; and 7) continue evaluation of both existing and newly-developed CDS implementations.

To meet these objectives, the GLIDES team continued to work with several national guideline development organizations, including the American Academy of Pediatrics and American Academy of Otolaryngology-Head and Neck Surgery, to design, implement, and pilot processes and tools intended to make guidelines clearer and easier to implement. In earlier phases of the project, four separate CDS applications for obesity and asthma were designed, built, and implemented in primary care and specialty settings. The CDS applications were enhanced at Yale and Nemours. At Yale, this included a formal evaluation of usability and the piloting of an iPad-enabled data capture front-end system for their specialty CDS system. This is a major and potentially transformative change to the way CDS is delivered for Yale pulmonologists, and it will be pursued further in 2012.

Based on feedback and input from GLIDES partners and other CDS contractors, GLIDES designed and implemented improvements to GEM and its related guideline implementation tools. Lastly, the project team participated in a range of dissemination activities, meetings, and presentations, and published nine academic papers that detailed GLIDES results in various areas.

Preliminary Impact and Findings: The experience of GLIDES' four implementation partners demonstrates that transitioning from recommendations expressed in statement logic to functional decision support is a complex and multi-faceted process. Several groups offered guidance for successful implementation, and an evolving set of considerations represents the current approach.

Among the preliminary findings, the GLIDES team discovered the importance of making sure that processes, methods, and tools intended to aid implementation of CDS operate within the context of an organization's in-place infrastructure when designing and implementing IT-enabled capabilities. CDS-specific processes, methods, and tools must be adaptable to an organization's in-use system. Each GLIDES implementer took a slightly different approach to bridging the structured knowledge specification outputs from GEM to their own processes and tools for designing changes to EHR systems. The varied techniques reflect differences in the guidelines being implemented, in the systems development practices of each organization, and in the technical infrastructure being used for the EHR.

Effective implementation planning is key to adoption and adherence. Stand-alone guideline implementation projects do not work well, but should be part of a broader and well-supported quality-improvement effort, potentially integrated with maintenance of certification or the Centers for Medicare and Medicaid Service's Meaningful Use requirements. When planning for adoption, implementers should also consider incentives, feedback loops, site-based guideline "champions", and integration of performance measurements. Implementers should also include evaluation of adherence and outcomes in CDS design up-front, since ensuring access to appropriate and granular data for outcomes reporting is a key challenge.

Target Population: Chronic Care*, Obesity, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision-making through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Table 14: Master Contracts Through Which Active Health IT Task Orders Were Issued

Master Contracts Through Which Active Health IT Portfolio Task Orders (TO) Were Issued:				
Completed in 2011	Principal Investigator	Project Title	Contract Number	Page of Summary
Accelerating Change and Transformation in Organizations and Networks (ACTION)				
Yes	Bell, Douglas, MD	Building an Implementation Toolset for E-Prescribing	290-06-0017-4	361
Yes	Doebbeling, Bradley, MD, MS	Implementing and Improving the Integration of Decision Support into Outpatient Clinical Workflow	290-06-0013-3	363
Yes	Hook, Mary L., PhD, APRN	Using Evidence-Based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-Related Patient Injuries in Acute Care	290-06-0016-2	365
No	Hurd, Donna, MSN	Evaluation of AHRQ's On-Time Pressure Ulcer Program	290-06-0011-8	367
Yes	Jack, Brian, MD	Using Innovative Communication Technology to Improve the Health of Young African American Women	290-06-0012-7	369
Yes	Resnick, Helaine, PhD	Telemonitoring in Rural Elder Nutrition Centers: Demonstration Project of Hypertension Management	290-06-0024-2	372
Yes	Ridgely, Susan and Koppel, Ross, JD and PhD	Developing a Guide to Identifying and Remediating Unintended Consequences of Implementing Health Information Technology	290-06-0017-5	374
Yes	Uhrig, Jennifer, PhD	Using Short Message System (SMS) to Improve Health Care Quality and Outcomes Among HIV-Positive Men	290-06-0001-7	376
No	Walker, Jim, MD	Health IT Hazard Manager	290-2006-000111-14	378
Evidence-based Practice Centers (EPC)				
Yes	Lobach, David F., MD, PhD, MS	Enabling Health Care Decisionmaking through the Use of Health Information Technology	290-07-10066-1	380
Yes	McKibbon, Ann, MLS, PhD	Enabling Medication Management through Utilization of Health Information Technology	290-07-100601-5	382
Yes	O'Connell, Mary Ellen, MMHS	Human Factors in Home Health Care	AHR7128	385
Medicaid/CHIP Technical Assistance Contract				
Yes	Austein-Casnoff, Cheryl, MPH	Quality Oral Health Care through HIT	290-07-10039T-1	387
Yes	Dimitropoulos, Linda, PhD	Technical Assistance for Health Information Technology and Health Information Exchange in Medicaid and the Children's Health Insurance Program	290-07-10079T	389
No	Thompson, Chuck, PhD	Barriers to Meaningful Use in Medicaid	290-07-10079-2	391
Interagency Agreement				
No	Finley, Scott, MD, MPH	Development of a Model Electronic Health Record Format for Children	290-2009-000231-3	393
No	Lamer, Christopher, Pharm.D., BCPS, MHS, CDE	Health Information Technology to Support Integration of Self-Management Support in Primary Care Delivery	IAA 10-663F-10	395
Yes	Shiffman, Richard N., MD, MCIS	Improving Guideline Development and Implementation	09-587F-07	397

General Health IT Task Order				
No	Felt-Lisk, Susan, MPA	Synthesis Reports for Grants and Cooperative Agreements for Transforming Health Care Quality Through Information Technology	290-09-00019I-3	399
Yes	Grossman, Joy, PhD	Effective Use of e-Prescribing in Physician Practices and Pharmacies	290-05-0007-3	402
No	Khan, Fatima, MPH, PMP	Pathways to Quality through Health IT	290-2009-00024I	404
No	McCormack, Lauren, PhD, MSPH	Improvements and Upgrades to the Electronic Preventive Services Selector	290-09-00021I	405
No	Montague, Enid, PhD	Understanding Development Methods from Other Industries to Improve the Design of Consumer Health Information Technology	290-09-00023i-10	407
Yes	Osheroff, Jerry, MD	Structuring Care Recommendations for Clinical Decision Support	290-09-00022I-2	409
Yes	Peikes, Deborah, PhD, MPA	Establishing Federal Resources to Support Patient-Centered Medical Home Concept	290-09-00019I-2	411
No	Shoemaker, Sarah, PharmD, PhD	Improving Electronic Health Record Patient Education Materials	290-09-00012I-4	413
No	Syed, Dani	Patient-Centered Medical Home Resource Center Public and Private Web Portals	290-09-00005I-3	415
Yes	Waldren, Steven, MD, MS	Patient-Centered Medical Home Information Model	290-09-00023i-6	417
Primary Care Practice-Based Research Network (PBRN)				
No	Fiks, Alexander, MD, MSCE	The Give Teens Vaccines Study	290-07-10013-4	419
No	Krist, Alexander, MD, MPH	Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions between Care Settings	290-07-10011-3	421
No	Mold, James, MD, MPH	Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions between Care Setting	290-07-10009-5	423
No	Pavlik, Valory, MD	Evaluation of Computer Generated After Visit Summaries to Support Patient-Centered Care	290-07-10007-2	425
Yes	West, David, PhD	Assessing the Impact of the Patient-Centered Medical Home	290-07-10008-3	427

Building an Implementation Toolset for E-Prescribing

Principal Investigator:	Bell, Douglas, M.D.
Organization:	RAND Corporation
Contract Number:	290-06-0017-4
Project Period:	August 2008 – September 2011
AHRQ Funding Amount:	\$999,825

Summary: This project developed and tested complimentary e-prescribing toolsets that act as how-to guides for implementing e-prescribing across various ambulatory care settings and pharmacies. The toolsets were authored as a collaborative effort among researchers from the RAND Corporation; Point of Care Partners, LLC; the University of California, Los Angeles; the University of Medicine & Dentistry of New Jersey; and Manatt Health Solutions. The toolsets—one for health care providers and another for pharmacies—provide guidance on the complete life cycle of activities expected to contribute to successful implementation.

Several successful e-prescribing initiatives were analyzed to assess key practices or features such as governance agreements, organizational characteristics, individual attitudes and motivations, prescription-related work processes, specific e-prescribing technologies and standards used, distinctive implementation practices, and estimated costs (versus savings), for each participating organization. Toolset contents were also drawn from observations in diverse practices that use e-prescribing, expert opinions from the project's advisory committee, and existing tools.

Pilot testing of the toolsets was done among prescribers and pharmacies that were in the process of e-prescribing adoption. Field researchers visited each practice before and after the e-prescribing draft toolsets were piloted to conduct semi-structured interviews and observations of work processes. The toolsets were evaluated on usability and usefulness in helping a broad range of practices to implement e-prescribing.

The findings from the analysis provide guidance and customizable aids to help organizations follow the practices or develop characteristics that contribute to successful implementation. The guidance included goal-setting, timelines, workflow patterns and feasible work process transitions, and direction on other key organizational factors that support adoption of innovations such as leadership, organizational culture, employee involvement, training, and performance evaluation and incentives. Draft versions of the toolsets will be available for extended pilot testing to the Office of the National Coordinator for Health Information Technology-funded Regional Extension Centers through the Health Information Technology Resource Center's Communities of Practice.

Project Objectives:

- Catalogue publicly-announced, ongoing e-prescribing initiatives. **(Achieved)**
- Assess contributors to successful implementation of e-prescribing initiatives. **(Achieved)**
- Create two draft e-prescribing implementation toolsets. **(Achieved)**
- Evaluate the draft toolset's usability and usefulness in helping provider organizations implement e-prescribing. **(Achieved)**

- Create a final e-prescribing implementation toolset based on findings from the pilot evaluation. **(Achieved)**

2011 Activities: Project activity focused on completing the pilot testing of the toolsets and conducting post-pilot visits to each participating practice. The project team interviewed practice staff and observed workflow processes to inform the evaluation of the toolsets' usability and usefulness in helping practices implement e-prescribing. The findings were then analyzed and summarized in a final report. Two [e-prescribing implementation toolsets](#) were developed; one aimed at health care provider organizations, the other at independent pharmacies. The project was completed in September 2011.

Impact and Findings: Among the physician offices that participated in pilot testing, those that had recently adopted e-prescribing achieved a level of success that they considered acceptable, at least at 1-month after implementation. However, in general, the use of the toolsets was considerably less extensive than anticipated. One reason for this was the difficulty of identifying practices at an appropriately early stage of planning for e-prescribing but with sufficient commitment to move forward to warrant enrollment in the site-visit protocol. In the end, the practices that could commit to moving forward had typically already selected a particular e-prescribing product and in many cases had already adopted an implementation plan, either from their vendor or their support organization. Therefore, these practices did not feel they needed the implementation-related content in the toolset.

The project team's strategy of facilitating toolset use via personnel from outside support organizations did not appear to increase use of the toolset. One potential reason may be that frequency of visits from the support personnel and their power to affect change in the practice were probably too limited to have a substantial impact. Scheduling time with physicians participating in the study was a contributing challenge. Many sites cited the daunting volume of information in each toolset and the challenge of locating resources of interest within the toolset as obstacles to toolset use. Since the toolset specifically recommends work process redesign, future revisions of the toolset should provide more explicit guidance on this topic. The toolset now indicates that pharmacies should address the issue of tailoring implementation resources and training with their vendor early in the implementation process.

The adoption and uptake of e-prescribing will likely remain a substantial challenge in coming years. The findings from this research suggest that an effective approach to assisting with this challenge may require a larger up-front investment of time and intensity of training. This applies both to the activities of support staff in training and working with members of practices, and to the activities of trainers themselves in learning to use the toolsets.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Implementation and Use

Implementing and Improving the Integration of Decision Support into Outpatient Clinical Workflow

Principal Investigator: Doebbeling, Bradley, M.D., M.Sc.
Organization: Indiana University
Contract Number: 290-06-0013-3
Project Period: September 2007 – March 2011
AHRQ Funding Amount: \$394,622

Summary: Computerized clinical decision support (CDS) and the use of electronic medical records (EMRs) can improve clinical decisionmaking, adherence with evidence-based guidelines, and quality of care. However, the implementation of CDS into clinical settings is not well understood, and poor integration can hinder its use and minimize its benefits. Common barriers to implementation include poor interface design, usability problems, and failure to accommodate the workflow of a clinical environment.

This project is a field study and controlled simulation analysis on integrating CDS for colorectal cancer screening into outpatient clinical workflow. The team used key informant interviews to identify site-specific best practices; direct observation of colorectal cancer screening CDS to identify barriers and facilitators to workflow integration; rapid prototyping of design alternatives based on findings from the direct observations; and controlled simulation to test the impact of design on efficiency, usability, and workload. The three study participants—the Regenstrief Institute, the Department of Veterans Affairs (VA), and Partners Healthcare System—use different EMRs but according to a [systematic review](#) published in 2006, are all institutions that have improved quality and efficiency by using CDS.

During the first phase, the team conducted site visits to collect qualitative data on factors for effective integration of CDS into clinical workflow in different EMRs. The second phase used measurable attributes—including efficiency, usability, and workload—from the first phase to develop and test alternatives for improved clinical workflow integration in a simulated setting with experienced users.

Project Objectives:

- Identify key approaches to CDS development for colorectal cancer screening at two VA Medical Center sites and two nationally recognized non-VA sites to obtain effective CDS integration into clinical workflow. **(Achieved)**
- Develop and test CDS design alternatives for improved integration into clinical workflow through a controlled simulation study and subsequent implementation. **(Achieved)**

2011 Activities: The project team completed all work on this project by the end of 2010 and spent most of the first few months of 2011 disseminating the findings. Members of the research team presented a poster, [Impact of a Redesign for Colorectal Cancer Screening Computerized Decision Support](#) and a presentation, [Investigating Integration of Computerized Decision Support into Workflow at Three Benchmark Institutions](#) at the Veterans Affairs Health Services Research and Development Service 28th Annual National Meeting in February 2011. A manuscript, [Redesign of a Computerized Clinical Reminder for Colorectal Cancer Screening: A Human-Computer Interaction Evaluation](#) describing the results was published in the November 2011 volume of *BMC Medical Informatics and Decision Making*.

Findings from this study directly informed the design of a prototype cancer screening support tool funded by a contract from the Centers for Disease Control and Prevention.

Impact and Findings: EMR and CDS systems differed across the sites. Despite design differences, there were common generalizable barriers, including: 1) lack of coordination among “outside” exam results, primary care, and specialty care; 2) poor data organization and presentation; 3) omission of provider and patient education in the decision support tool; 4) lack of interface flexibility; 5) the need for technological enhancements; 6) unclear role assignments; 7) organizational issues; and 8) disconnect between decision support and quality reporting.

Design enhancements to the VA’s existing colorectal cancer screening clinical reminder positively impacted aspects of usability and workflow integration, but not workload. The qualitative analysis revealed broad participant support for the design enhancements and specific suggestions for improving them further. This type of lab-based human-factors evaluation of CDS and other informatics tools is critical for testing design changes prior to implementation.

Overall, the team found that identifying effective strategies in the design, implementation, and integration of CDS into workflow is crucial for effective cognitive support. Despite the use of several different health systems, barriers were quite consistent. Effective design and integration of new technologies requires mindful iteration. There is a need for new CDS prototypes that: 1) improve data organization and presentation; 2) integrate outside results; and 3) provide just-in time education and cognitive support. Designing and testing prototypes using these features may help inform the next generation of cognitive support.

Target Population: Adults, Cancer

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decision making through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

Using Evidence-Based Nursing Practices and Electronic Health Record Decision Support to Reduce Fall-Related Patient Injuries in Acute Care

Principal Investigator: Hook, Mary, Ph.D., R.N., P.H.C.N.S.-B.C.
Organization: Aurora Health Care System Nursing Research
Contract Number: 290-06-0016-2
Project Period: June 2009 – January 2011
AHRQ Funding Amount: \$387,369

Summary: Advances in health information technology (IT), particularly the use of clinical decision support systems (CDSSs) in electronic health records (EHRs), hold great promise for enhancing the safety, quality, effectiveness, and efficiency of patient care. However, limited use of these advances by nurses has been reported. Many nurses continue to develop, implement, and document their care plans on paper with little automation, limited access to CDSS, and manual abstraction for quality reporting. Research is needed on how, when, and where CDSS can be used to increase quality and patient safety for acute-care nurses.

This project was a collaboration between investigators at Aurora Health Care System Nursing Research, the University of Wisconsin-Milwaukee Colleges of Nursing and Health Sciences, and the Cerner Corporation. The research team added new tools to an existing CDSS within an EHR to help nurses individualize care for groups of patients and improve fall and injury prevention processes and outcomes. The team used evidenced-based recommendations and input from academic partners and experts in fall prevention, technology acceptance, and cost-benefit analysis to develop a data dictionary, qualitative and quantitative assessment measures, and CDSS design.

The project was implemented with nurses who worked on two medical or telemetry nursing care units in one large urban medical center. The facility had a pre-existing EHR with fall prevention and injury management data elements, electronic care planning functionality, and CDSS tools that identified fall and fall-related injury risks using data entered during patient care. This CDSS project involved the creation of two new electronic report tools for nurses. One report tool used a dashboard to display the status of risk assessment, planned interventions, and outcomes to support nurses to evaluate and adjust their fall prevention care plans for individuals and groups of patients at a key point in their workflow. The other report tool displayed retrospective data about fall prevention care and fall event details that unit-based nurse leaders could use to monitor their results and tailor their quality improvement efforts. In addition to creating the reports, the team developed patient and family education materials, staff and nurse leader education materials, and a data dictionary of standardized terminology. A pre/post mixed-methods design, including data queries, direct unit observation, focus groups, surveys, and usability testing was used. Qualitative and quantitative measures were used to identify recommended tool content and logistical design, and evaluate post-implementation outcomes.

Evaluation results were disseminated to key clinical and informatics leaders to influence future work in this area. The data dictionary, support tools, findings, and lessons learned will contribute to the available knowledge of improvements in patient safety and quality of IT-supported nursing care, and help reduce CDSS development and implementation costs.

Project Objective:

- Design, build, and implement CDSS tools that were populated with data extracted from the EHR and to evaluate if the CDSS tools could support nurses to improve care planning and quality improvement activities, and patient or family education related to fall prevention in acute care. **(Achieved)**

2011 Activities: The focus of activity was on developing a final report for the study. The project was completed in January.

Impact and Findings: Despite providing input into design, the nurses and nurse leaders were slow to adopt the tools. The dashboard that displayed the status of risk assessment, planned interventions, and outcomes used an EHR-provider based template and was accessible in the EHR with a single click. The tool functioned as designed with a clean visual display but did not provide enough detail about patient-specific risks and interventions to be considered useful. Prolonged load time was a significant barrier to regular use during report and patient care.

The retrospective data about fall prevention care and fall event details required the use of an EHR-provider template with significant customization. The tool populated accurately and comprehensively, bringing rich data about fall prevention and fall events including externally reported quality indicators without manual abstraction. Usability testing showed that nurse leaders could access the tool and believed the tool brought disparate data together, saving time and improving data quality. The nurse leaders reported competing priorities and found no time to use the tool during the evaluation period.

Similarly, staff nurses provided positive feedback about the patient and family education materials, but there was limited evidence of use during the post-implementation period.

This study demonstrated that nurse-sensitive data, embedded in the EHR, can be captured and extracted from the data repository to create tools that support decisionmaking during patient care, and for retrospective aggregate analysis and quality improvement. However, the CDSS tools were not adopted as widely as expected. Sociotechnical context issues such as time constraints, competing EHR implementations, and resource reduction were observed during training, go-live, and adoption periods that may have influenced adoption. Sociotechnical context is not typically captured in CDSS research. Gathering these details provides information and insight into factors that influence the adoption and use of technology beyond the technical aspects.

Transitioning to evidence- and data-driven processes may require a new understanding about how nurses adopt and use electronic tools to support decisionmaking. Despite limited adoption, this study sheds light on the complexities of nursing workflow, sociotechnical context issues that influence adoption, and factors to consider in future research on CDSS tools and nurse decisionmaking.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

Evaluation of AHRQ's On-Time Pressure Ulcer Program

Principal Investigator:	Hurd, Donna, M.S.N.
Organization:	Abt Associates, Inc.
Contract Number:	290-06-0011-8
Project Period:	June 2009 – January 2012
AHRQ Funding Amount:	\$1,699,797

Summary: Pressure ulcers and injurious falls have serious health and economic consequences for elderly residents in nursing homes. Although substantial research has documented that preventing pressure ulcers and falls is possible, these problems persist across health care settings. In the last decade, many initiatives—including an earlier Agency for Healthcare Research and Quality (AHRQ)-funded On-Time Pressure Ulcer (PrU) Healing program, which helps nursing homes implement best practice guidelines in PrU care through workflow redesign and process improvements—have been undertaken to improve quality of pressure ulcer care in nursing homes. While the On-Time program has unique characteristics, it had not previously been formally evaluated and thus was not ready for wide dissemination.

This project evaluated AHRQ's On-Time PrU program. The findings will help make guidelines available to other practices. Lessons from the PrU program will also inform the development of an On-Time Fall Prevention Module, which will use documentation data elements, actionable reports, and tracking tools on risk factors from the On-Time PrU program. These resources will allow nursing home staff to intervene in a timely manner with at-risk residents to reduce the incidence of injurious falls. The project team worked with facilities to develop a feasible implementation plan to integrate these tools into daily practice.

A yearlong process of workgroup meetings has already informed the standardization of fall documentation and the development of tools to guide clinical decisionmaking for fall prevention. In addition, several facilities participated in a series of teleconference calls to develop health information technology specifications based on the final set of fall prevention tools. Early in the project, the original scope of work was expanded to include two additional tasks: 1) a review of literature and analysis of national data to identify residents in nursing homes who should be targeted for prevention protocols to reduce hospital and emergency department (ED) visits; and 2) development and testing of a training curriculum for the On-Time PrU Prevention program and modification of the Team Strategies and Tools to Enhance Performance & Patient Safety (TeamSTEPPS) program for nursing homes. TeamSTEPPS is a training system designed to help health care professionals provide higher-quality, safer patient care and create a culture of safety within their health care teams.

Project Objectives:

- Evaluate the effect of the On-Time PrU by comparing 15 New York nursing homes that have implemented the program with 12 to 15 control nursing homes. Information on pressure ulcer incidence provided by the facilities for a 12-month period and adjusted for resident risk factors using minimum data set (MDS) data will provide the data needed to assess the effectiveness of the On-Time program for reducing pressure ulcers. **(Achieved)**
- Design the tools and establish the foundation for a fall prevention implementation effort using an approach similar to the On-Time PrU prevention, including standardized documentation data

elements that can be integrated into everyday practice, actionable reports of resident fall risk factors, and tracking tools. **(Achieved)**

- Develop an evidence-based systems approach for identifying, managing, and monitoring multiple risk factors for hospitalizations and ED visits. **(Achieved)**
- Develop the On-Time Train-the-Trainer and TeamSTEPPS for long-term care curricula. **(Achieved)**

2011 Activities: Thirteen control and 13 intervention facilities were recruited and worked with the project team to submit census and pressure ulcer data for this study. The study team made site visits to four facilities. The project team found that each facility, including control and intervention sites, has required an individualized strategy to facilitate submission of the data needed for the study instead of the standardized approach initially envisioned. Therefore, the team conducted many rounds of followup telephone calls and emails to determine the agreed-upon data submission strategies. All facilities were eventually able to submit electronic census data and some form of pressure ulcer data. Data received from facilities were then checked and cleaned, which necessitated further rounds of followup telephone calls and emails with control and intervention facilities to check missing and inconsistent data. The most common problem was residents listed in the pressure ulcer records with no corresponding information in the census data for the same dates.

The study team has linked census data to the MDS using facility-provided resident identifiers. Preliminary testing of the data linking process showed that in some cases the linking could be accomplished quite readily using the medical record number supplied by the facility, while in other cases the linking yielded numerous problems. At the end of 2011, construction of the analytic file was completed, with an overall MDS match rate of 75 percent.

Meanwhile, various modules in the TeamSTEPPS manual have been revised, including those focused on leadership, team structure, situation monitoring, mutual support, and communication. Filming for a TeamSTEPPS video was completed in September 2011 and revisions are ongoing.

Sections of the draft final report were submitted to AHRQ in November. The draft report included sections on background, data collection, and analysis methods (nursing home recruitment, data sources and data collection, analytic file construction), and baseline description of intervention and control facilities. Analysis of the data continues and final details of the analytic model are under discussion.

Prior to 2011, there were substantial delays (out of the team's control) in obtaining the data files needed for the avoidable hospitalization analysis. In 2011, the project team proposed a revised timeline that would not affect the estimated cost or performance of the contract. The project was extended 12 months and completed in January 2012.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: Adults, Elderly*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Using Innovative Communication Technology to Improve the Health of Young African-American Women

Principal Investigator: Jack, Brian, M.D.
Organization: Boston University
Contract Number: 290-06-0012-7
Project Period: July 2009 – October 2011
AHRQ Funding Amount: \$399,504

Summary: While research has revealed significant racial disparities in pregnancy outcomes, national programs to improve pregnancy outcomes center on providing care for women during pregnancy and helping them enter prenatal care early. This project is part of an emerging effort to engage young women and improve their health before they get pregnant.

The project included the development of an intervention to promote the health of African American women who are 15-to-21-years old. It used theory-based behavioral change techniques and an existing clinical patient education system—the Virtual Patient Advocate (VPA), previously developed by a team led by the principal investigator under an AHRQ-funded study—to deliver the behavior change intervention. The VPA is an innovative communication channel that features an animated computer character that simulates face-to-face conversation with patients via the Internet. Previously, the researchers applied aspects of this technology to provide patient education upon hospital discharge. This VPA system featured novel social networking capabilities to increase the reach and efficacy of the new intervention.

Research staff conducted focus groups to solicit participants' recommendations to maximize the target population's uptake of the system by building relevant behavioral messages and ensuring that the VPA system is convenient and easy to use. The system was adapted from the VPA originally designed for the ReEngineered Discharge program (Project RED) to provide: 1) a personalized and comprehensive assessment of preconception risks; 2) culturally appropriate health promotion messages; and 3) an individualized behavior change discussion for each risk identified. This integration of social networking technologies increased the reach of the intervention while increasing adherence to its recommendations.

Project Objectives:

- Design a new VPA for a Web-based behavior change and patient activation system that is informed by qualitative research with the target audience. **(Achieved)**
- Develop VPA dialogue for 15- to-21-year-old African American women. **(Achieved)**
- Develop a social networking interface that allows users to recommend other people who could benefit from the intervention, and perform a proof-of-concept test of this new system to improve the health of African American women. **(Achieved)**
- Analyze the impact of the newly designed system. **(Achieved)**
- Disseminate this new technology to at least two other academic medical centers. **(Achieved)**

2011 Activities: The VPA was modified based upon user feedback. Enrollment for pilot testing was completed at the preconception peer educator training, a project of the Office of Minority Health. Members of the research team explained the study to potential participants and conducted the consent process. Participants were then given a username and password to log into the VPA system and complete the intake questionnaire. Each participant went through a demonstration of the system with the character Gabby to get a brief introduction on how to use the system. The demonstration gave participants the opportunity to listen to information from three pre-determined health risks, and required them to write a story to make sure that the story writing process was clear before they started using the system from home. The research team found that the story writing process is key in promoting social networking and developing peer-to-peer connections. After the demonstration, each participant filled out a survey regarding her feedback about the system and was given a handout with instructions for using the system from home.

All data analysis was completed. Data will be reported in publications and will focus on: 1) system usage from the pilot; 2) risk assessment results; and 3) qualitative work, including focus groups and pre-testing interviews.

Due to time needed in other areas of development, such as major adjustments to the story-authoring tool based on pre-test feedback, the team was not able to incorporate social networking functions into the VPA system. However, the current system can be updated with various social networking functions, such as providing each user with a landing page and allowing users to comment on each other's stories for future projects.

Impact and Findings: Focus group findings provided key insights into the VPA. Participants indicated that the stories should be in first person, from the perspective of the system users instead of the VPA agent. Across all eight focus groups, participants confirmed that they use Facebook and that the system should at least have some Facebook-like functionalities. Participants thought that the overall layout and design of the health survey were straightforward and easy to navigate. Also, participants thought that the questionnaire was very long and would prefer to have the option to fill it out over multiple sessions. This feature will be part of future projects.

Pre-testing showed that participants felt that the health survey was useful, easy to complete, and took an appropriate amount of time. Eighty percent of participants felt that it was easy to talk to Gabby; 73 percent 'trusted' Gabby; and 87 percent felt comfortable telling Gabby everything about their health. Eighty percent would use health information from Gabby to improve their health, and 87 percent felt that Gabby did a good job answering their questions. Seventy-three percent felt that the session with Gabby was just the right length. Eighty percent of participants reported that they would use their My Health To-Do List, which is a list of participant goals based upon their health survey, and 67 percent indicated that they would write their own stories from home if they could continue using the system.

During the 2-month pilot, six of the nine pilot testing participants logged in to the Gabby system at least once. For those six participants, there were a total of 63 sessions during the 2-month trial, for an average of seven sessions per user and maximum of 18 sessions. The average session lasted 12 minutes, and ranged from 2 to 32 minutes. Two participants reviewed all of their risks; on average, each participant who logged in to the system at least once reviewed 11 risks. There were 128 total risks identified, 67 of which (53 percent) were discussed with Gabby. Of the 67 risks discussed, participants chose to add 43

to their My Health To-Do List, for an average of 7.2 risks per participant. When asked at the 2-month followup phone call about the risks that were added to the “My Health To-Do List,” participants reported that 83 percent of their risks were either resolved or the participant had taken some action to resolve them.

Target Population: Racial or Ethnic Minorities*: African Americans, Teenagers, Women*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

**This target population is one of AHRQ's priority populations.*

Telemonitoring in Rural Elder Nutrition Centers: Demonstration Project of Hypertension Management

Principal Investigator: Resnick, Helaine, Ph.D.
Organization: LeadingAge
Contract Number: 290-06-0024-2
Project Period: July 2009 – April 2011
AHRQ Funding Amount: \$399,919

Summary: Despite extensive public and professional education and the availability of efficacious treatments, hypertension remains the most common and strongest risk factor for cardiovascular disease in North America. Hypertension is present in more than 70 percent of Americans aged 80 and older, and it is the single most important risk factor for stroke. Improved approaches to patient self-management are increasingly viewed as an integral part of the health care process, and offer particular promise for conditions such as hypertension. Telehealth may provide a novel approach to enhancing the ability of older adults to manage hypertension and other chronic conditions, especially if this technology is delivered in community-based settings that are easily accessed by seniors.

This project is one of the Agency for Healthcare Research and Quality (AHRQ)-sponsored Accelerating Change and Transformation in Organizations and Networks (ACTION) projects designed to promote innovation in health care delivery by accelerating the diffusion of research into practice. Under the leadership of Dr. Helaine Resnick, this demonstration project was conducted by a partnership consisting of researchers from LeadingAge and Wright State University; Healthanywhere, a telehealth technology company; and four senior centers in Ohio. The study was designed to explore the feasibility of installing telehealth kiosks in community-based senior centers and using telehealth technology to manage blood pressure (BP) in a setting that targets high-risk elderly patients. Study participants included hypertensive adults who received nutrition assistance at one of the four senior centers involved in the project. Two of the centers installed telehealth kiosks that allowed participants to conduct self-monitoring of their BP any time they use the center. Two sites did not have kiosks and served as control facilities. Blood pressure data from telehealth stations at the intervention centers were streamed to a secure central server managed by a telehealth vendor and monitored by study nurses. Data was collected on hypertension baseline and endpoints such as physician visits and medication titrations, with a focus on comparisons between participants at intervention and control facilities.

The results of this pilot study are the first step in determining the promise of further research in this area.

Project Objectives:

- Determine proof-of-concept for a system in which telehealth monitors can be utilized to manage BP in a community setting that targets high-risk elders. **(Achieved)**
- Compare BP control in a telehealth group to BP control in a control (non-telehealth) group. **(Achieved)**

2011 Activities: Enrollment and participant followup were completed in 2010; the focus of activity in 2011 was on data analysis and development of the final report. The project was completed in April and a final report was delivered to the AHRQ in June.

Impact and Findings: Study participants were highly compliant with use of the technology, but use dropped off somewhat over the 10 months of followup. Ninety-five percent of participants reported being “very comfortable” with use of the telehealth kiosk at the end of the study, and senior center directors reported overall satisfaction on the part of their clients and their staff with the kiosk. Many participants commented on the convenience of having the equipment set up at the senior center because they were there on a regular basis for activities. Thus, participation and ongoing BP measurements did not impose any added burden on seniors beyond the time involved in taking the measurements. Center directors also reported that at the completion of the project, they felt that the telehealth device was easy for seniors to use and that staff were seldom tapped for questions or assistance.

Study nurses reported a high degree of satisfaction with the technology, but indicated that having access to the health care portal on a mobile device would have been a good addition to the technology platform. Nurses reported the ability to provide quick and effective nursing interventions in response to elevated blood pressure readings but expressed that greater access to participants’ physicians would have helped study nurses utilize the technology more effectively. Based on these findings, future research might explore how to move the nurse monitoring aspect of the project into the primary care setting or integrate it into the senior center’s stream of services allowing direct communication with the primary physicians’ office. Although an office-based approach to nurse management was beyond the scope of this project, this project highlights the potential additional benefits that could be realized by incorporating nurse-mediated management in the office setting. However, financing is one of the major barriers inhibiting the proliferation of this type of technology. Therefore, incorporating nurse-mediated management in the office setting would not be feasible unless it was covered by Medicare or other health insurance plans.

Future research on the efficacy and cost-effectiveness of this telehealth approach for chronic disease management could provide evidence supporting the adoption of this approach into regional or national networks of senior centers. Studies could also focus on operational and logistical issues associated with building bridges between physicians who care for seniors and senior centers that are routinely utilized by these individuals. This line of investigation would significantly contribute to advancing community-based, communication-focused technologies for this vulnerable population.

Target Population: Elderly*, Hypertension, Low SES/Low Income*, Rural Health*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ’s priority populations.*

Developing a Guide to Identifying and Remediating Unintended Consequences of Implementing Health Information Technology

Principal Investigator:	Ridgely, Susan, J.D., and Koppel, Ross, Ph.D.
Organization:	RAND Corporation
Contract Number:	290-06-0017-5
Project Period:	May 2009 – June 2011
AHRQ Funding Amount:	\$399,894

Summary: The use of new health information technology (IT) has been shown to enhance the quality, safety, and effectiveness of medical care. However, there are also unanticipated and undesired effects of health IT implementation—often called unintended consequences—that can be difficult to identify during a technical analysis or pilot test of the new technology. The RAND Corporation, in partnership with Kaiser Permanente of Colorado and the American Health Information Management Association (AHIMA), have developed, conducted user testing of, and disseminated the empirically-grounded Web-accessible *Guide to Reducing Unintended Consequences of Electronic Health Records*. This guide synthesizes the existing knowledge on types and causes of unintended consequences and presents strategies to avoid or address them.

The project was a collaboration of six major health care settings and groups representing a geographically diverse group of provider organizations that included inpatient and outpatient care delivered in academic and community settings. These organizations were either in the process of implementing a variety of health IT components from several vendors or were planning to do so in the near future. Depending on health IT implementation status and preferences, participants served either as laboratory sites to help develop the guide or as pilot sites to test it. The laboratory and pilot tests sites differed in settings (rural/urban), size (academic centers and solo physician practices), and scope of practice (inpatient/ambulatory), and therefore offered a range of perspectives and helpful feedback.

The guide will help organization leaders understand sociotechnical sources of unintended consequences and may help them avoid undesirable effects of health IT implementation. This knowledge will allow organizations to develop a process to diagnose and cope with emergent consequences. This process may even help prevent undesirable outcomes and provide opportunities for learning about and improving health care delivery. Examples of the target audience for the guide include regional extension centers, chief information officers, directors of clinical informatics, practitioners serving as champions of health IT, hospital and clinic administrators, and implementation oversight teams. Front-line health IT users, including physicians and nurses, should also find the guide useful.

Specific Aims:

- Synthesize the existing knowledge on types and causes of unintended consequences and strategies to avoid or address undesired consequences. **(Achieved)**
- Develop the draft version of the guide, and instructions for its use. **(Achieved)**
- Pilot test the guide at three additional sites to assess its usability and usefulness. **(Achieved)**
- Revise the guide and disseminate final version in a Web-accessible format through several methods. **(Achieved)**

2011 Activities: The focus of activity was on completing and disseminating the final version of the guide. The guide had been pilot-tested at four sites in 2010 to assess its usability and usefulness. Revisions were made in 2011 in response to the feedback received. The project was completed in June 2011. The guide was prepared in a Web-based format and is now available at <http://www.healthit.gov/ucguide>. It represents a compilation of the known best practices for anticipating, avoiding, and addressing electronic health record-related unintended consequences. Because this area of research is still in its infancy, the guide is considered to be a work in progress.

Impact and Findings: Unintended consequences can undermine provider acceptance, increase costs, sometimes lead to failed implementation, and even result in harm to patients. Examples of unintended consequences include but are not limited to: more work for clinicians, unfavorable workflow changes, conflicts between electronic and paper-based systems, and overdependence on technology. If organizations learn to anticipate and identify unintended consequences, they will be in a better position to make effective decisions, clarify tradeoffs, and address problems as they arise.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Synthesis and Dissemination

Using Short Message System (SMS) to Improve Health Care Quality and Outcomes Among HIV-Positive Men

Principal Investigator: Uhrig, Jennifer, Ph.D.
Organization: Research Triangle Institute
Contract Number: 290-06-0001-7
Project Period: March 2009 – March 2011
AHRQ Funding Amount: \$399,950

Summary: Mobile phone use is widespread throughout the world, including in the United States; among the general U.S. population, 83 percent of adults own a mobile phone. People who frequently have higher rates of cell phone use include younger adults, less-educated young adults, people who rent or move frequently, and individuals who demonstrate health-compromising behaviors.

Short message service (SMS)—or text messaging—is the most widely used data application in the world, and is a quick, convenient way to deliver targeted and timely information via mobile phone. The pervasiveness, low-cost, and convenience of cell phone technology make SMS messaging an effective way to communicate with and give patients health-related messages.

This project studied the potential of SMS to support the adoption and maintenance of healthy behavior among people who live with HIV/AIDS and are treated in ambulatory care settings. Dr. Jennifer Uhrig and her research team developed, implemented, and evaluated an SMS intervention to assist HIV-positive men who have sex with men (MSM) from the Chicago, Illinois area in better managing their disease and well-being. The intervention used text messaging to promote medication adherence and appointment attendance, reduce risk-taking behaviors, and enhance social support, general health and well-being, and patient involvement.

The clinical and systemic goals were to develop an intervention that was straightforward, relatively inexpensive, and easily implemented in ambulatory HIV/AIDS care settings. The intervention also had to be acceptable and useful to people living with HIV/AIDS and have a positive influence on health care quality and outcomes. The project team evaluated the implementation process and outcomes.

Project Objectives:

- Conduct a thorough review of existing literature, paying close attention to work that has been completed on innovative uses of text messaging in health communication strategies. **(Achieved)**
- Develop and implement an SMS-based intervention to improve health care quality and outcomes by providing tailored health communication messages to HIV-positive patients who are treated in ambulatory care settings. **(Achieved)**
- Conduct a process evaluation on implementation and determine the feasibility and potential for implementing the intervention in other ambulatory care settings. **(Achieved)**
- Conduct an outcome evaluation that focuses on patient satisfaction and the impact of the intervention on targeted knowledge, attitudes, beliefs, intentions and behaviors, health care quality, and outcomes measures. **(Achieved)**

2011 Activities: The focus of activity was on completing data analysis and developing the final report. The project was completed in March 2011.

Impact and Findings: The project successfully designed and implemented a low-cost, high-impact health communication and information technology. The study enrolled 52 HIV-positive MSM patients from the Howard Brown Health Center in Chicago, Illinois into the 3-month SMS intervention. Forty-six patients completed the intervention, including a pre- and post-intervention assessment survey. The implementation and outcomes of the intervention were evaluated using qualitative interview data from study patients and providers, and data collected from study surveys, the SMS system, and the study team.

In general, the intervention resulted in improved health care quality and outcomes for HIV-positive MSM. Participants were receptive to and satisfied with the intervention and messaging. The intervention resulted in the following key outcomes:

- **Medication Adherence Improved.** Patients who received SMS medication reminder messages had a significant decrease in missed doses from baseline to follow-up.
- **Viral Load Decreased.** Overall, the average viral load of the study patients significantly decreased from baseline to follow-up.
- **HIV Knowledge Improved.** Overall, the average HIV knowledge score among study patients increased from baseline to follow-up.
- **Increased Social Support.** While many patients entered the study reporting good social support systems in place, there was a significant overall increase in social support from baseline to follow-up among all participants and among participants who received social support messaging.
- **Reduced Number of Sex Partners.** The number of sex partners reported by patients decreased significantly from baseline to the 3-month follow-up. Specifically, the number of patients who reported having had sex with no one in the 3 months changed from zero to two from baseline to follow-up.

The results from this study indicate that when messaging is designed and customized for individual patients and patient populations, it can motivate behavior change to help HIV-positive MSM better manage their disease and stay healthy.

Target Population: Chronic Care*, HIV/AIDS, Men*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, coordination of care across transitions in care settings, and use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Health IT Hazard Manager

Principal Investigator:	Walker, James, M.D.; Geisinger Health System
Organization:	Abt Associates Inc.
Contract Number:	290-2006-00011I-14
Project Period:	August 2010 – May 2012
AHRQ Funding Amount:	\$763,135

Summary: This project focused on developing and testing a software tool called the Health IT Hazard Manager. The goal of the Hazard Manager is to enable providers to classify and communicate hazards related to the use of electronic health records (EHRs) and other health information technology (IT) so that problems can be fixed or controlled before they cause patient harm. An example of a hazard would be entering an order for the wrong patient, which could be due to the user interface or the absence of an automated patient identity confirmation.

Rather than looking retrospectively at accidents or near-misses, the Hazard Manager is designed to collect structured information about hazards associated with specific health IT products. The Hazard Manager collects information about four main components of hazards: discovery, causation, impact, and corrective action. The system collects information on the nature of the hazard, its cause, and how it was corrected. The Hazard Manager can help health care providers assemble consistent and organized information about the potential hazards identified in their IT products, as reported by other users of the same products. When deployed regionally or nationally, health care organizations will benefit from a mechanism to consistently categorize, manage, and resolve hazards, and understand hazards others have encountered in the next upgrade of their IT products. The Hazard Manager will also allow health IT vendors to view hazards their customers have identified and prioritize fixes for future upgrades. The Hazard Manager contains three levels of security: 1) participating health care organizations can enter and see information about its own hazards and those reported by unidentified others who use the same products; 2) vendors can view hazards reported by their unidentified customers; and 3) health care organizations, vendors, policymakers, and researchers can view aggregated, unidentified reports of all hazards.

The Beta test was conducted under the auspices of a patient safety organization (PSO). Beta test participants entered several hazards per week for 6 months. They also entered hazard scenarios (vignettes) to test inter-rater differences. The Hazard Manager was evaluated on usability and usefulness and refined accordingly, based on group and individual discussion with participating health care organizations, their software vendors, and federal policymakers.

Project Objectives:

- Design, build, and test the Hazard Manager software. **(Achieved)**
- Beta test the Hazard Manager software in six to eight study sites. **(Achieved)**
- Refine the ontology based on findings from the Beta test. **(Achieved)**
- Deliver a fully-tested and refined version of the Hazard Manager software and final report. **(Ongoing)**

2011 Activities: The primary focus of activities in the first 9 months of the project was on designing, planning, and programming of the Hazard Manager software, finalizing PSO agreements with participating

health care organizations, and obtaining a review waiver from the institutional review board (IRB). Beta testing began with seven sites and Beta test data entry included nearly 500 actual hazards. Data analysis was completed in December 2011. Due to delays in obtaining signatures on the PSO agreements and receiving the IRB waiver, the contract was extended by 3 months with a new project end date of May 2012.

Preliminary Impact and Findings: There were several discoveries that resulted from the Beta testing of the Hazard Manager, such as finding that an individual’s role determines the types of hazards they become aware of. For example, the IT implementation teams learn about potential hazards during testing, while patient safety teams may learn about care process compromises during their review of patient care. Hospitals have separate IT and patient incident reporting systems that, while not explicitly designed for hazard identification, can help teams identify hazards.

Failure to control hazards are often labeled as “user error;” the Hazard Manager focuses on the missing safeguards in IT systems that fail to protect users from making mistakes. Hazards are often labeled “software design flaws;” the Hazard Manager specifies whether these flaws are related to usability, data quality, or software specifications. In terms of impact on patients, the Hazard Manager captures the severity, duration, and type of harm—focusing not only on physical harm but also raising awareness about psychological, financial, and reputational harm.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Enabling Health Care Decisionmaking Through the Use of Health Information Technology

Principal Investigator:	Lobach, David, M.D., Ph.D., M.S.
Organization:	Duke University
Contract Number:	290-07-10066-I
Project Period:	September 2009 – February 2011
AHRQ Funding Amount:	\$405,000

Summary: Access to and utilization of knowledge, information, and clinical data via health information technology (IT) can facilitate clinical decisionmaking and communication. While the use of clinical decision support systems (CDSS) has the potential to make evidence-based practice guidelines available to clinicians at the point of care, there is uncertainty and concern about workflow disruption, usability in practice, and utility of content.

Duke University's Evidence-based Practice Center (EPC) developed a synthesis report summarizing the evidence on the use and effectiveness of CDSS across clinical settings. The report is one of three reports summarizing the state of the evidence on medication management using health IT, decision support tools, and consumer health informatics applications and their respective effect on the quality of care. The Duke EPC report focuses on facilitating health care decisionmaking with health IT. As part of the work, they convened a technical expert panel to advise them on the key questions and state of the evidence. The EPC conducted the comprehensive systematic literature search, reviewed and analyzed the existing evidence, and identified gaps in knowledge. The final report synthesizes key knowledge gaps and existing peer-reviewed research to provide critical information on developing and using electronic knowledge management, defined as any electronic system based on the distillation of primary literature used at the point-of-care to inform decision making and CDSS.

Project Objectives:

- Identify what evidence-based study designs can be used to determine the effectiveness of CDSS. **(Achieved)**
- Identify what contextual factors and features influence the implementation and use of electronic knowledge management and CDSS. **(Achieved)**
- Identify the impact of introducing electronic knowledge management and CDSS. **(Achieved)**
- Identify what generalizable knowledge can be integrated into electronic knowledge management and CDSS to improve health care quality. **(Achieved)**

2011 Activities: The focus of 2011 was dissemination of results. The [final report](#) for the project was completed at the end of March. A manuscript describing the results, [Effect of Clinical Decision-Support Systems: A Systematic Review](#), was written and accepted in 2011 and published in the *Annals of Internal Medicine* in April 2012. Dr. Lobach participated in a national Web conference, Findings from the Evidence-Based Practice Centers for Health IT, hosted by the National Resource Center for Health IT at AHRQ in July, which featured the results and findings from the three EPCs.

Impact and Findings: The literature search identified 13,752 articles, from which 131 randomized control trials (RCTs) were selected for inclusion. These RCTs comprised 49 percent of the comparative studies on CDSS or electronic knowledge management. The project team determined that both commercially and locally developed CDSS deployed in many venues effectively improve process measures related to performing preventive services, ordering clinical studies, and prescribing therapies. Of the 14 CDSS features assessed in this review, the meta-analyses identified four new factors and features that correlated with the success of CDSS across all endpoints: 1) integration with charting or order-entry system to support workflow; 2) promotion of action rather than inaction; 3) elimination of additional clinician data entry; and 4) local user involvement in the development process. The project team identified only 25 RCTs assessing the impact of CDSS on clinical outcomes, 20 assessing costs, and two assessing electronic knowledge management on any outcomes.

This review found strong evidence that CDSS improve process measures across diverse academic and nonacademic settings using both commercially and locally developed systems. Evidence for the effectiveness of CDSS on clinical outcomes and costs and electronic knowledge management on any outcomes is minimal, and more studies are needed in these areas.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Synthesis and Dissemination

Enabling Medication Management Through Utilization of Health Information Technology

Principal Investigator: McKibbin, K. Ann, M.L.S., Ph.D.
Organization: McMaster University
Contract Number: 290-07-100601-5
Project Period: June 2009 – February 2011
AHRQ Funding Amount: \$415,975

Summary: McMaster University has produced one of three evidence report in a series on the strategic goals of the Agency for Healthcare Research and Quality's (AHRQ's) Health Information Technology (IT) Portfolio. This report focuses on improving medication management through health IT applications. Because of the diversity of health IT applications being developed and the different ways that impact can be measured, the review includes peer-reviewed scientific literature, conference proceedings, and grey literature. The report considers many health IT applications, including e-prescribing applications, computerized provider order entry, clinical decision support, bar-coded medication administration, pharmacy-based health IT applications, electronic medication administration records, and other IT-based medication management tools.

The report synthesizes the evidence on medication management health IT (MMIT) to understand health IT's impact and set future direction for the field. Medication management involves many actors and interactions, beginning with the prescribing or ordering of medications by clinicians, interactions between clinicians and pharmacists to perfect the pharmacists' medication dispensing and administering of medications, and clinical monitoring of the effects of the medications. The report also assesses the use of health IT for medication reconciliation and educational activities. Studying the integration and utilization of medication management and IT systems will lead to a better understanding of how health IT improves or could improve the quality, safety, and sustainability of medication management.

Project Objective:

- Summarize evidence on the extent to which health IT enables improved quality and safety in the medication management phases, which include but are not limited to: 1) accurate and timely prescribing of medication in response to a specific patient; 2) correct first-fill and refill dispensing of medications; 3) appropriate administering of medication, and; 4) patients' taking of the pharmaceutical treatment regimen as prescribed. **(Achieved)**

2011 Activities: The [final report](#) for this project was submitted to AHRQ in December 2010, ahead of the project's scheduled end date of February 2011. The report was posted to the AHRQ National Resource Center for Health IT Web site in early 2011.

Impact and Findings: The literature search retrieved 40,582 articles that were screened using titles and abstracts. From a full-text screen of 4,356 articles, 428 articles were summarized in the report. Another 361 articles on topic but with limited data were included in a bibliography.

Most of the studies in this evidence report are quantitative observational assessments, often using historical controls. Randomized controlled trials and other methodologies with controlled populations

and multi-centered demonstration studies are lacking. Those that exist often have inadequate details or weak methods, which result in only incremental additions to the evidence base for the use of MMIT. Sustainability studies, strengthened study methods, fuller descriptions of MMIT applications and settings, and reporting standards are still needed.

Evidence for evaluating MMIT is strong for prescribing and monitoring, especially for hospitals and primary care settings. The evidence from these studies indicates process improvements, often measured as improvements in medication orders during the prescribing and monitoring phases. The bulk of this evidence of improvement is shown in studies set in hospitals. Improvements in use, knowledge, skills, and attitudes were also found to be associated with MMIT systems. These cumulated changes can, but may not always, lead to efficiency and cost gains. In contrast, little work has been done on other phases of medication management that use integrated health IT. Some IT applications used in dispensing and administering are stand-alone technologies and, by definition, not included in this report.

Little evidence was found of significant improvement in clinical outcomes with MMIT. Possible reasons include the small number of events, the outcomes being far removed from the application of the technology, and that the clinical aspects were often not the studies' main endpoints. It is also not known whether MMIT applications are cost-effective because of a lack of sound economic data. User groups, including nurses and pharmacists, evaluate systems and features differently and have needs and preferences that sometimes are in conflict with other groups of health professionals. The qualitative literature highlighted positive and negative perceptions and differing levels of satisfaction with the integrated health IT applications, supporting the importance of carefully assessing the effects of the health IT on workflow and the working relationships of the users.

A number of areas of study, most notably order communication, dispensing, administration, reconciliation, and education, are poorly addressed in the literature. Inpatient care is the most studied setting, followed by ambulatory care; whereas few studies assessed long-term care and pharmacies, especially those outside hospitals. Regarding technology, most of the studies evaluated computerized decision support systems or computerized provider order-entry systems. The report identified gaps in the evidence of the effects of MMIT applications in the domain of patient and informal caregiver access to MMIT applications. Another important gap is in the assessment of MMIT tools that nonphysicians use. These gaps are especially true for applications that are integrated with existing clinical applications, such as electronic medical and personal health record systems. A patient-centered focus for MMITs promises a new and exciting domain of study.

The value of MMIT systems needs to be assessed across financial, clinical, and organizational components. The value proposition for each stakeholder will be different based on his or her value set. Individual and group values have not been studied well. For example, what is important to nurses and pharmacists may not be viewed similarly by physicians or patients. Although some evidence suggests positive financial and organizational gains, they are not universal and depend on the technology, the setting, and the impact on the stakeholders using them. Clinical benefit is not assessed well in the literature. Existing evidence seems to indicate no or very small clinical benefit from MMIT applications. Rigorous studies are needed to accurately assess economic and other values.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Synthesis and Dissemination

Human Factors in Home Health Care

Principal Investigator:	O’Connell, Mary Ellen, M.M.H.S.
Organization:	National Research Council
Contract Number:	AHR7128
Project Period:	September 2009 – October 2011
AHRQ Funding Amount:	\$750,000

Summary: The National Research Council Committee on Human-Systems Integration has formed the Committee on the Role of Human Factors in Home Health Care, a multidisciplinary consensus panel of experts. This panel was brought together to examine a range of behavioral and human-factors issues and challenges that have arisen due to the increasing migration of medical devices, technologies, and care practices from formal health care facilities into private homes. Although relatively little has been established empirically about these challenges, it is recognized that homes are not designed for the delivery of health care, that considerable variation exists as to what constitutes a ‘home,’ and that patients and their caregivers—whether professional or lay providers—are at risk for harm when administering care in a safe and reliable manner outside formal care facilities.

This project helped gain a better understanding of:

- The human-factors challenges that take into account the relevant sensory, behavioral, and cognitive capabilities of patients and caregivers.
- The nature of the care processes, procedures, and therapies occurring in the home.
- The steady migration and use of medical equipment and technologies to the home environment.
- How the design of the physical home environment can facilitate or impede the delivery of care.
- The impact of social and community environments on healthy lifestyles.

The Committee sought to determine how current and emerging human-factors knowledge and methods, as well as future research, could improve the safety, effectiveness, cost-effectiveness, and other aspects of the quality of health care in the home. The papers and resultant workshop summary, [Human Factors in Home Health Care: Workshop Summary](#), informed the committee’s deliberations for its final report, [Health Care Comes Home: The Human Factors](#).

Project Objectives:

- Produce a consensus report identifying and discussing major human-factor issues in home health care. **(Achieved)**
- Produce a brief companion designer’s guide for home-based consumer health IT. **(Achieved)**

2011 Activities: The focus of activity was on finalizing the consensus report and designer’s guide, and coordinating dissemination activities with the Agency for Healthcare Research and Quality. Due to unexpected transitions in project leadership in 2010, the project was slightly delayed and therefore the contract was extended beyond the original end date of October 2010. The project was completed in October 2011.

Impact and Findings: Improvements to health care in the home hold the promise of providing healthy living, comfort, and effective treatment to care recipients and to contribute to a growing and vital part of health care delivery in the United States. The final report documents the current state of health care in the home and identifies existing problems and opportunities for the improvement of care by applying human factors knowledge and methods. The report includes discussion of several themes and issues that influence the effective delivery of health care in the home. These topics include the diversity of populations receiving and providing health care in the home; unmet needs to match medical device technology with the capabilities and limitations in the home environment; necessary training, support, and appropriate documentation for those using home health care equipment and technology; and the need to improve coordination and communication among those involved in health care in the home.

To address each issue, the research team developed a number of recommendations within four areas in which human factors can help improve various aspects of health care in the home, including: 1) health care technologies, including medical devices; 2) caregivers in the home, including formal and informal caregivers and those who self-administer care; 3) residential environments for health care; and 4) the design of equipment and information technology or provision of services to those in need.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

Quality Oral Health Care Through Health Information Technology

Principal Investigator:	Austein-Casnoff, Cheryl
Organization:	National Opinion Research Center
Contract Number:	290-07-10039T-1
Project Period:	June 2010 – June 2011
AHRQ Funding Amount:	\$89,861

Summary: Disparities in access to quality dental care between privately and publicly insured beneficiaries are a well-documented and longstanding concern for children in public programs and dentists who could provide their care. The lack of essential dental care results in consequential functional impairments and lost educational opportunities for children. For dentists, the failure to engage in public insurance programs represents lost opportunities to serve a large population that has significant need. It is estimated that fewer than 7 percent of primary care dentists' patients are Medicaid, compared to 28.5 percent of pediatric physicians' patients. Far fewer dentists (approximately 20 percent) participate in Medicaid than do pediatricians (89.5 percent).

New federal incentives created by the American Recovery and Reinvestment Act of 2009 and its Health Information Technology for Economic and Clinical Health Act provisions are designed to engage health care providers in developing and implementing health information technology (IT) and health information exchange in ways that can improve access and quality of essential health services. These tools promise to expand and improve care, enhance reporting and accountability, engage patients in their own wellness, create virtual networks of providers, and expand dentists' linkages to primary health care and use of clinical guidelines and protocols.

While data are limited, it appears that dentistry lags behind medicine in adopting health IT and benefiting from the implementation and meaningful use of health IT systems. One key barrier is the absence of certified dental IT software that meets Meaningful Use criteria. As a result, vendors should accelerate efforts to create electronic health record (EHR) and electronic dental record applications for dentists to meet these requirements.

In order for dentists to take advantage of Meaningful Use incentive payments, they would need to meet a minimum Medicaid patient volume threshold of 30 percent. Expanding incentives to dentists may encourage them to provide dental care to Medicaid-insured children who receive inadequate oral health care.

This project helped to identify the impact of Meaningful Use incentive payments on dentists serving Medicaid-eligible children and how these payments might expand access to quality oral health care for children enrolled in Medicaid and/or the Children's Health Insurance Program (CHIP). The results offer a valuable opportunity to bring together individuals in various disciplines to offer recommendations for ways in which health IT, payment incentives, Medicaid, and the children's oral health fields can work together to better provide access to oral health care for low-income children.

Project Objectives:

- Develop a background report on health IT and dentistry for the expert panel meeting. **(Achieved)**

- Invite participants and convene an expert panel meeting. **(Achieved)**
- Produce a final report and PowerPoint presentation. **(Achieved)**

2011 Activities: The team held an expert panel that included individuals from the fields of Medicaid/CHIP, dentistry, and health IT. The panel made recommendations on ways to use health IT to increase access to oral health care for children enrolled in Medicaid and CHIP. Project staff drafted a final report that included barriers and opportunities for health IT adoption by dentist; barriers to and opportunities for dentists to meet Meaningful Use requirements; and strategies for using the functionalities of health IT to increase access to quality oral health care for Medicaid and CHIP enrollees. The background report completed in 2010 as part of the first aim was included as an appendix in the final report. Project staff also created a PowerPoint presentation on the findings.

Impact and Findings: The following findings and recommendations were formulated from the work on this project.

- More certified dental systems need to be developed.
- Standards should be developed to enhance the interoperability of dental EHRs.
- Detailed standards and specifications are needed to guide dental vendors in creating products.
- Provide reimbursement for procedures that depend on or would be improved by the use of health IT.
- Increase awareness of available hardware and software.
- Decrease the financial burden of purchasing a dental EHR.
- Support the use of open-source products among dentists.
- Dental providers need to continue to communicate with Centers for Medicare and Medicaid Services regarding specific measures that are relevant and correspond to the workflow patterns and care-delivery processes in dentistry.
- Dentists need to be educated on the Meaningful Use requirements.
- Afford flexibility for dentists to practice within or contract with a Federally-Qualified Health Center.
- By reducing cumbersome administrative requirements, health IT functionalities may encourage dentists who currently do not include Medicaid or CHIP children in their practices to do so.
- By integrating medical and dental care, either virtually or actually, some vulnerable children may be referred to dental care more frequently, allowing for earlier, less-invasive and costly treatment with substantially better health outcomes.
- By supporting strategies to encourage increased adoption of clinical decision support, dentists may be better positioned to provide quality care to patients.

Target Population: Low-SES/Low Income*, Medicaid, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

**This target population is one of AHRQ's priority populations.*

Technical Assistance for Health Information Technology and Health Information Exchange in Medicaid and the Children's Health Insurance Program

Principal Investigator:	Dimitropoulos, Linda, Ph.D.
Organization:	RTI International
Contract Number:	290-07-10079T
Project Period:	September 2007 – February 2011
AHRQ Funding Amount:	\$2,990,592

Summary: As the largest purchasers of health care for low-income and other vulnerable populations in the United States, Medicaid and the State Children's Health Insurance Program (CHIP) are well-positioned to support the adoption and implementation of health information technology (IT) and health information exchange (HIE) to improve services for their clients. Medicaid and CHIP agencies have been working to increase involvement in the planning and implementation of health IT systems. The goal of this project was to improve the coordination and quality of care by providing technical assistance (TA) to agency personnel to plan and implement health IT and HIE.

RTI International (RTI) developed and implemented a 3-year TA program for Medicaid and CHIP agencies based on multiple sources of information including a needs assessment, a multistate collaborative, and ongoing communication and interaction among the participants. The information that project staff collected included current and planned health IT and HIE projects and implementation plans of the Medicaid and CHIP agencies; TA needed to accomplish the plans and projects; cost and value data to develop a business case for technology adoption; program evaluation planning; barriers and challenges to current or planned health IT and HIE plans; and preferences for how TA should be provided.

RTI developed and maintained a repository of health IT- and HIE-related information specific to Medicaid and CHIP. RTI also developed and maintained a Medicaid and CHIP-specific section of the Agency for Healthcare Research and Quality's National Resource Center for Health IT (NRC) Web site. The project systematically reviewed and synthesized the literature on costs and value of established health IT and HIE, and supported a set of ongoing health IT and HIE communities of practice for Medicaid and CHIP agency staff. RTI also set up a hotline with a toll-free number that personnel at agencies could call to ask a member of the RTI team questions about the project.

Project Objectives:

- Complete a nationwide assessment of Medicaid and CHIP health IT and HIE plans. **(Achieved)**
- Develop a 3-year TA plan based upon findings of nationwide assessment. **(Achieved)**
- Establish a menu of additional tools and strategies to support Medicaid and CHIP health IT and HIE development. **(Achieved)**

2011 Activities: RTI continued to work with Federal- and State-level partners to monitor the factors that affect the health IT and HIE needs of Medicaid and CHIP. Project staff continued to update information about Medicaid and CHIP agencies' initiatives, their plans to respond to the American Recovery and Reinvestment Act regulations through 2011, and their needs for TA.

Project staff also continued to develop and deliver a comprehensive series of free Webinars, Web-based workshops, and in-person workshops on a wide range of health IT and HIE topics featuring national experts and leaders. Topics were selected based on information gathered from the nationwide Medicaid and CHIP needs assessment, ongoing monitoring, and input received from the project's technical expert panel.

Project staff maintained two communities of practices, which ran concurrently in 2011. One focused on Medicaid involvement in State HIE, the other on managing multiple health IT projects in Medicaid and CHIP. These served as open, collegial platforms for staff to access and exchange up-to-date information on health IT issues that are most relevant to Medicaid and CHIP agency staff.

Case studies describe best practices and lessons learned regarding health IT adoption and HIE participation as reported by Medicaid agencies and from one-on-one interviews with agency staff. One addition to the series of State-specific case studies was developed and posted on the NRC Web portal in 2011.

The section of the [NRC Web site](#) that RTI developed and maintained contains static information about the project, a calendar of all scheduled TA sessions, links to 508-compliant materials from all Webinars and Web-based workshops provided since the start of the project, and links to all publicly-released reports created under the project.

Impact and Findings: The Year 1 needs assessment analysis revealed that: 1) most agencies had at least one health IT initiative and more than half had at least two; 2) many States and territories had plans to evaluate the value of their health IT initiatives but few could provide details; 3) the main challenges for agencies were costs, infrastructure and other resources, provider adoption, sustainability, and system technicalities; 4) best practices and lessons learned involved planning and budgeting, increasing communication and coordination, early and frequent stakeholder engagement, and acquiring appropriate staff and expertise; 5) the primary challenges to HIE initiatives were infrastructure and resource issues; 6) quality improvement and increased communication and interoperability were reported most frequently as the primary goals and objectives of the HIE initiatives; and 7) half the reporting agencies had limited or no plans to evaluate their HIE efforts.

A discussion in September 2010 with technical expert panel members from the Centers for Medicare and Medicaid Services and the Office of the National Coordinator for Health IT concluded that the TA and other support services provided by this program filled an important gap in their respective programs and engaged a group of stakeholders that was not otherwise targeted. Sustained participation and positive evaluation results for Webinars, Web-based and in-person workshops, and community of practice meetings through the end of the project in February 2011 supported this observation.

Target Population: Low Income/Low SES,* Medicaid, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

** This target population is one of AHRQ's priority populations.*

Barriers to Meaningful Use in Medicaid

Principal Investigator:	Thompson, Chuck, Ph.D.
Organization:	Research Triangle Institute
Contract Number:	290-07-10079-2
Project Period:	June 2010 – June 2012
AHRQ Funding Amount:	\$396,722

Summary: The Health Information Technology for Economic and Clinical Health Act (HITECH) offers financial incentives for Medicaid providers to adopt and meaningfully use certified electronic health record (EHR) technologies. To ensure that eligible professionals, including physicians, dentists, certified nurse-midwives, nurse practitioners, and some physician assistants, are able to qualify for and access these incentives, this 2-year project is studying the barriers that Medicaid providers encounter when they try to achieve ‘meaningful use’ as defined in the Centers for Medicare and Medicaid Services’ (CMS’) EHR Incentive Program. The project provides actionable recommendations to help Medicaid providers take advantage of incentive payments, achieve meaningful use, and ultimately use health information technology (IT) to improve health care for the Medicaid population.

Data for this project are being collected from both in-person and virtual focus groups with physicians, pediatricians, dentists, and mid-level providers. A technical expert panel (TEP) comprised of key stakeholders, including staff from the Office of the National Coordinator (ONC) for Health IT, CMS, and the Health Resources and Services Administration, has provided guidance on the research plan, data collection design, and implementation plan. The panel will also provide guidance on data analysis and final report recommendations.

These activities will help Federal stakeholders understand the barriers to meaningful use among Medicaid providers and will help inform future Federal regulations.

Project Objectives:

- Identify the barriers to eligibility for the incentive payments; barriers to adoption, implementation, or upgrading of EHR systems; and barriers to achieving meaningful use. **(Ongoing)**
- Develop actionable recommendations to overcome barriers identified above, including but not limited to technical assistance that could be made available to Medicaid providers. **(Ongoing)**
- Provide data to inform the meaningful use objectives being developed by CMS for Stages 2 and 3 of the EHR Incentive Program. **(Upcoming)**

2011 Activities: In October, the study team received approval from the Office of Management and Budget to conduct the focus groups, which will be held in 2012. Subsequently, pilot testing of the focus group questionnaires was conducted among one in-person focus group, one virtual focus group, and two one-on-one interviews; one with a private family physician with no EHR and the other with a private practice pediatrician with no EHR. The team experienced challenges recruiting non-adopters of EHR to the pilot discussions, but among the pilot participants the discussions were found to be helpful to the project team. The remainder of the project timeline includes conducting a total of 17 focus groups (three in-person, 14 virtual), analyzing the findings, and developing a final report.

Preliminary Impact and Findings: There are no findings to report at this time.

Target Population: Adults, Medicaid, Pediatric*, Safety Net

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

** This target population is one of AHRQ's priority populations.*

Development of a Model Electronic Health Record Format for Children

Principal Investigator:	Finley, Scott, M.D., M.P.H.
Organization:	Westat
Contract Number:	290-2009-0023I03
Project Period:	March 2010 – November 30, 2012
AHRQ Funding Amount:	\$4,749,214

Summary: Existing electronic health record (EHR) systems typically are designed, implemented, and used with an adult patient population in mind and therefore do not always support the provision of health care to children. Special medical and other considerations that arise in pediatric patient care are often missing or poorly supported.

Westat is collaborating with several organizations to develop and disseminate a model EHR format for children enrolled in Medicaid or Children's Health Insurance Programs. The "format" refers to the various requirements for data elements and standards, usability, functionality, and interoperability. The project team is working to understand how the model format, its structure, and content might be used to develop new or enhance existing EHR products to help providers optimize health care for children. The goals of this project are supported by a technical expert panel to ensure broad stakeholder input at every stage of the project. Two Children's Health Insurance Program Reauthorization Act grantees also are testing and evaluating the format's impact on quality and cost of care.

The outcome of this project will identify core elements of an EHR for children that can be incorporated into vendor systems, and will provide guidance to users of EHRs about the ideal functionality of EHRs for children.

Project Objectives:

- Conduct an environmental scan and gap analysis. **(Achieved)**
- Develop a model EHR format for children that can be used readily. **(Ongoing)**
- Package the EHR format in a way that facilitates broad incorporation into EHR systems. **(Upcoming)**

2011 Activities: The focus of activities in 2011 was on finalizing the EHR format and initiating the development of two prototypes based on selected format requirements, growth charting and medication management. The contract was extended by 8 months to enable a number of activities to be undertaken in 2012. These include developing and incorporating additional enhancements of the format; conducting a conformance assessment of the format requirements relative to several selected vendor products; finalizing the two prototypes; and developing a process for a key stakeholder feedback process and validation approach.

Preliminary Impact and Findings: The environmental scan and gap analysis suggest that existing EHR systems and products lack a number of functionalities related to more than 30 topic areas (growth data, newborn screening, medication management, etc.) related to the treatment of children and for which the project is currently developing requirements.

Target Population: Medicaid, Pediatric*

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Health Information Technology to Support Integration of Self-Management Support in Primary Care Delivery

Principal Investigator:	Lamer, Christopher, Pharm.D., B.C.P.S., M.H.S., C.D.E.
Organization:	Indian Health Service
IAA Number:	IAA 10-663F-10
Project Period:	June 2010 – May 2012
AHRQ Funding Amount:	\$300,000

Summary: In 2007, the Indian Health Service (IHS) Chronic Care Initiative (CCI) began to implement strategies within the IHS to improve the health status of patients and populations affected by chronic conditions and to reduce the prevalence and impact of those conditions. Efforts focused on developing patient- and family-centered care processes that apply across multiple chronic conditions, instead of separately managing individual diseases. This work is done in the Improving Patient Care for the Indian Health Service (IPC-IHS), a learning community collaborative. IPC-IHS is designed to close the gap between what is known through evidence and what is practiced.

Self-management support (SMS) is the care and encouragement of people with chronic conditions to help them understand their own role in managing their illness, make informed decisions about care, and engage in healthy behaviors. It requires patients and care providers to share information and create an appropriate care plan, and is a key component of patient-centered health care and the chronic care model. This project is designed to support the improvement of the delivery of prevention and care management services through the IHS CCI.

Two questions arising from IPC work on SMS are: 1) what elements (e.g., goal setting, action planning, followup) can be integrated into the electronic health record (EHR) to help prompt and document SMS within a newly-designed model of care?; and 2) what key measure(s) should be collected from the EHR to drive performance improvement? This 2-year project is striving to help answer these questions and to understand, develop, and test EHR elements to improve the delivery, documentation, and tracking of SMS services in the IPC care model.

Project Objectives:

- Develop and test electronic integration of clinical decision support and tracking into the IHS electronic health record system. **(Ongoing)**
- Implement electronic support for clinical decision and tracking for SMS services. **(Ongoing)**
- Publish a manuscript describing the work of IHS to improve the provision of primary care services as it relates to this work and IPC. **(Upcoming)**

2011 Activities: Activities focused on developing and releasing the Resource and Patient Management System (RPMS), a patient goal-setting component for the IHS EHR. In addition to the EHR, IHS has their own personal health record (PHR) to provide patients with access to their medical record information in the RPMS. The PHR team is planning to develop a technical and clinical process to allow patients to enter their goals into their RPMS medical record via the PHR. The patient's designated clinician receives notification of the patient-entered data to promote prompt followup, support, and refinement of the patient's goals in order to facilitate an achievable and positive outcome.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Adults, Chronic Care*, Racial or Ethnic Minorities*: American Indian/Alaska Native

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

Improving Guideline Development and Implementation

Principal Investigator:	Shiffman, Richard N., M.D., M.C.I.S.
Organization:	Yale University
Contract Number:	09-587F-07
Project Period:	September 2006 – February 2012
AHRQ Funding Amount:	\$133,000

Summary: Over the past 15 years, there has been a lot of focus on developing, disseminating, and implementing clinical practice guidelines. A number of shortcomings— including challenges in the authoring process, quality defects in the production of guidelines, and obstacles to effective implementation— in the process of translating medical knowledge into systems that influence clinical behavior have been identified. Although systematic reviews have demonstrated that computerized systems can implement guidelines effectively in clinical practices, creating computer-mediated guideline implementation systems has also proven to be onerous and not uniformly successful.

Dr. Richard Shiffman and his research team at Yale University designed a research program on the effective representation of guidelines using ontologies. This study was designed to reduce guideline ambiguities, improve efficiency, and create and evaluate tools to facilitate the writing of comprehensive and implementable guidelines. The first generation of the software assistant Building Recommendations in a Developer's Guideline Editor (BRIDGE-Wiz) was developed in the earlier years of the project. It has been used in four guideline development efforts and has yielded good results. BRIDGE-Wiz formalizes and systematizes a process for creating implementable guideline recommendation statements. The tool takes a wizard approach to answering questions (such as under what circumstances, who, what level of obligation, purpose, and to whom, how, and why?). Natural language processing was applied to create and populate a template for recommendation statements. Overall, users found that BRIDGE-Wiz facilitated the development of clear, transparent, and implementable guideline recommendations. The findings from this program will promote an understanding of how to improve knowledge acquisition. In addition, the conclusions will help authors make precise and comprehensive guidelines in an unambiguous manner.

Project Objectives:

- Create a library of representative guideline recommendation statements that will be used to better understand and characterize the current corpus of guideline statements and to serve as a resource for modeling and evaluation activities. **(Achieved)**
- Delineate the range of ambiguous, vague, and underspecified language in recommendation statements and devise targeted remedies. **(Achieved)**
- Analyze the terminology of obligation (deontic components) used in guideline recommendation statements to understand how this concept can be applied most effectively. **(Achieved)**
- Create ontology of recommendations. **(Achieved)**
- Develop and evaluate a controlled language editor for use by domain experts to facilitate authoring of recommendations that can be translated into decision support tools. **(Achieved)**

2011 Activities: The first generation of BRIDGE-Wiz was developed in the earlier years of this project and, to date, has been used in more than seven guideline development efforts with good results. The focus of activities in 2011 was on evaluating and refining the system, developing and evaluating a “what you see is what you mean (WYSIWYM)” interface, and developing the final report. Several professional organizations, including the American Academy of Pediatrics and the American Academy of Otolaryngology Head and Neck Surgery, have incorporated BRIDGE-Wiz in their standard guideline development process. This WYSIWYM interface is expected to be used by domain experts to facilitate authoring of recommendations that can be translated into decision-support tools to enhance the accuracy of translation and ease implementation of new knowledge contained in guidelines.

The project team translated a set of guideline recommendation statements into Attempto Controlled English (ACE). ACE texts are computer-processable and can be translated unambiguously into discourse representation structures, a syntactic variant of first-order logic.

A contract extension allowed the project team to complete the final report. A project-related paper, [“Building better guidelines with BRIDGE-Wiz: a software assistant to promote quality, transparency, and implementability.”](#) was published in 2012.

Preliminary Impact and Findings: The team found that ACE can be used to express clinical practice guideline recommendations and ACE statements were judged to be acceptably “natural”-sounding. Principles identified can be used to improve the quality, clarity, and implementability of clinical practice guidelines. This represents some of the first work using controlled natural language in health care.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Synthesis Reports for Grants and Cooperative Agreements for Transforming Health Care Quality Through Information Technology

Principal Investigator:	Felt-Lisk, Suzanne, M.P.A.
Organization:	Mathematica Policy Research, Inc.
Contract Number:	290-09-00019I-3
Project Period:	September 2009 – June 2012
AHRQ Funding Amount:	\$744,420

Summary: This project is synthesizing the experiences of the 118 grants that comprise the Agency for Healthcare Research and Quality's (AHRQ's) Transforming Healthcare Quality Through Information Technology (THQIT) initiative. THQIT grants supported different aspects of organizational and community-wide activities in health information technology (IT) implementation in order to elucidate various stakeholders' perspectives and to demonstrate the value of health IT implementation and use.

The project collected data from original grant applications, peer-reviewed literature, and reports from the THQIT initiative to synthesize and report the experiences of the THQIT grantees. In summer 2011, a Web-based survey tailored to grant type was administered to all grantees to obtain standardized sets of key information across and within the four request-for-application groups of grantees. Semi-structured interviews with 16 grantees were conducted in fall 2011.

The framework for the data collection and analysis in this project includes the following questions:

- What features of planning and health IT partnerships were associated with effective planning, implementation and use, and improved health care processes and outcomes?
- What was the role of the grant and associated requirements in shaping the experience and outcomes of the projects, and how might the grant process be improved?
- What financial, organizational, technical, personnel, procedural, or other barriers were encountered, and what strategies have grantees found to overcome them?
- Where and to what extent have the implementation projects documented with strong or suggestive evidence improvements or detriments to patient safety, quality of care, or efficiency associated with their health IT implementations? Are certain project features or characteristics associated with better outcomes?
- What benefits do grantees report and what, if any, potential hazards, care process compromises, or safety incidents have been identified?

Project Objective:

- Generate reports that synthesize the experiences of the nearly 120 grants that comprise AHRQ's THQIT program. **(Ongoing)**

2011 Activities: The Web-based survey was administered to the THQIT grantees. Response rates to the survey were high, with 79 percent of planning grantees (30 of 38), 86 percent of implementation grantees (48 of 56), and 83 percent of value grantees (21 of 24) responding. Analysis of the survey was provided to

AHRQ, preliminary to preparation of the final synthesis report, which is due in spring 2012. Interviews were conducted with 16 grantees and highlights were provided to AHRQ in a memorandum, another preliminary step toward a final report. The contract was extended for an additional 9 months so that the project team can conduct additional semi-structured interviews at approximately 40 grantee sites. These interviews will further explore and potentially confirm preliminary themes communicated by THQIT grantees.

Impact and Findings: The literature review summary for implementation grantees found that relatively few grantees (13 of 54) were able to report strong evidence of the effects of their projects. However, those that did tended to find improved quality of care. The positive impacts included reduction in adverse drug events, reduced emergency department visits, and better adherence to care protocols. All five of the projects that attempted to show a reduction in medical errors from their health IT succeeded in this goal. Grantees whose projects demonstrated more positive impacts noted that various additional improvement efforts, such as workflow redesign or simultaneous attention to improving patient safety culture, were important to their success.

Two common barriers found to have a major impact on the implementation grant projects were: 1) difficulties integrating the new IT with existing IT systems or workflows; and 2) uneven commitment among partner organizations. Common facilitators included change-management strategies for planning and communication that involved stakeholders in design and implementation; strategies for managing a milestone-based project plan; the importance of a champion to serve as lead advocate for health IT use; and the importance of “super-users,” onsite individuals with designated time to help others adjust to and learn to use the health IT.

Across all projects, the literature review also identified barriers, strategies used by grantees who managed to avoid them, and benefits reported in published sources. The five most-frequently mentioned barriers were: 1) difficulty obtaining sufficient input from intended users; 2) budget planning to support implementation; 3) difficulty defining and purchasing necessary hardware and infrastructure improvements; 4) difficulty achieving trust and strong working relationships with collaborating organizations; and 5) privacy and security concerns.

Strategies for overcoming barriers included putting providers who are implementing IT technology changes in contact with providers who already used the technology; hiring an external health IT expert to review the benefits and costs of health IT implementation with administrative leadership; and assessing workflow prior to determining goals for health IT implementation or the type of health IT.

In their final reports to AHRQ, grantees reported several types of benefits including:

- Identification of implementation barriers and the opportunity to include methods to overcome them in implementation plans
- Assessment of (and in some cases, challenging) the appropriateness of health IT goals and methods, and providing the opportunity to change implementation plans
- Increased partner buy-in to value of technologies and fostering trust in collaboration
- New relationships
- Increased knowledge and understanding of the capacities and functions of technologies, as well as the complexities and challenges to successful implementation and integration

- Increased health IT infrastructure for smaller, resource-constrained providers
- Increased awareness of similar health IT projects regionally and nationally

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Synthesis and Dissemination

Effective Use of e-Prescribing in Physician Practices and Pharmacies

Principal Investigator:	Grossman, Joy, Ph.D.
Organization:	Center for Studying Health System Change
Contract Number:	290-05-0007-3
Project Period:	February 2009 – December 2011
AHRQ Funding Amount:	\$374,635

Summary: This project addressed the need for qualitative research about the effects of electronic prescribing (e-prescribing) on physician and pharmacy practice and communication. The potential gains from e-prescribing assume that prescribers and pharmacists have access to and make use of many of the system's available features. Limited research on the topic suggests that not all e-prescribing systems have the full range of features promoted under financial incentive programs established by the Medicare Improvements for Patients and Providers Act of 2008 and the American Recovery and Reinvestment Act of 2009. Further, even when the features are available, physician practices face barriers to implementing them effectively. Features may be implemented at the practice level, but physicians may not choose to use them. To gain the benefits from electronic transmission of prescriptions, both physician practices and pharmacies must routinely use systems enabled for two-way electronic communications. Identified obstacles in both the physician and pharmacy settings include information technology system limitations, workflow and training issues, and real or perceived regulatory barriers.

The Center for Studying Health System Change (HSC), a non-partisan health policy research organization in Washington, D.C., conducted a qualitative study exploring physician use of third-party information (i.e., medication histories, formularies, and generic medication alternatives) at the point of prescribing and physician practice and pharmacy use of electronic routing features. Information collected by the study will inform strategies for governmental and private health care organizations to promote adoption and effective use of e-prescribing capabilities.

Project Objective:

- Explore how e-prescribing features are implemented and used by physicians and pharmacies with a focus on selected features that have the potential to yield health care quality and cost benefits but that prior research has shown not to be available or used routinely by significant proportions of e-prescribers. **(Achieved)**

2011 Activities: The focus of activity in 2011 was on developing an HSC research brief titled, "Physician Practices, E-Prescribing and Accessing Information to Improve Prescribing Decisions" published by the HSC in May 2011 and a paper titled, "[Transmitting and Processing Electronic Prescriptions: Experiences of Physician Practices and Pharmacies](#)" published by the *Journal of American Medical Informatics Association* in November 2011.

Impact and Findings: While most of the practices studied reported that physicians had access to patient formulary information, only slightly more than half reported physician access to patient medication histories, and many physicians did not routinely review these sources of information when making

prescribing decisions. Study respondents highlighted two primary barriers to use: 1) tools to view and import the data into patient records were cumbersome to use in some systems; and 2) the data were not always perceived as useful enough to warrant the additional time to access and review them, particularly during time-pressed patient visits. To support generic prescribing, practices typically set their system defaults to permit pharmacist substitution of generics; many practices also used other tools to more proactively identify and select generic alternatives at the point of prescribing. Overall, physicians who more strongly perceived the need for third-party data, those in practices with greater access to complete and accurate data, and those with easier-to-use e-prescribing systems were more likely to use these features consistently.

The study team found that practices and pharmacies generally were satisfied with electronic transmission of new prescriptions but reported that the electronic renewal process was used inconsistently, resulting in inefficient workarounds for both parties. Practice communications with mail-order pharmacies were less likely to be electronic than with community pharmacies because of underlying transmission network and computer system limitations. While e-prescribing reduced manual prescription entry, pharmacy staff frequently had to complete or edit certain fields, particularly drug name and patient instructions.

The research team concluded that electronic transmission of new prescriptions has matured but that barriers to e-renewals, mail-order pharmacy connectivity, and pharmacy processing of e-prescriptions remain. Similarly, many e-prescribing systems provide electronic access to important information—for example, medications prescribed by physicians in other practices, patient formularies, and generic alternatives—when physicians are deciding what medications to prescribe. However, physician practices with e-prescribing face challenges using these features effectively. Improved data availability and usefulness, changes in technical standards and system design, along with more targeted physician and pharmacy training may be needed to address these barriers.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve the quality and safety of medication management via the integration and utilization of medication management systems and technologies.

Business Goal: Knowledge Creation

Pathways to Quality through Health IT

Principal Investigator:	Khan, Fatima
Organization:	Booz Allen Hamilton
Contract Number:	290-20-0900024-1
Project Period:	September 2011 – September 2013
AHRQ Funding Amount:	\$1,168,918

Summary: Recent legislative initiatives and new care delivery approaches have highlighted the importance of timely, targeted quality metrics, and the essential role of a robust and supportive information infrastructure. Significant progress has been made in understanding the requirements, capabilities, and best practices of such information systems. However, the sharp increase in initiatives to integrate measurement of health care quality and health information technology (IT) underscore that gaps in knowledge persist.

AHRQ's longstanding investment in building the evidence base on quality measurement through health IT is exemplified by funding opportunities such as the Ambulatory Safety and Quality: Enabling Quality Measurement funding opportunity announcement, which has supported innovative demonstrations, approaches, and methodological work. To continue these efforts, AHRQ seeks to develop a well-informed strategic plan to improve health care quality measurement through health IT that describes near-term (3-4 years) resource requirements, longer-term (5-7 years) issues, and subjects that must be addressed.

To this end, this project will engage in activities such as asking for public comments through a request for information and holding focus groups with experts and key stakeholder groups to articulate current obstacles to improving quality through health IT. This will inform a key deliverable of the project—the final report—that will attempt to characterize an ideal future health information infrastructure for actionable and prioritized national quality measurement and reporting.

Project Objectives:

- Develop a background report on the current state of quality measurement through health IT and relevant initiatives in health IT and quality measurement. **(Ongoing)**
- Gather stakeholder input on gaps in resources and knowledge in health IT and quality measurement. **(Ongoing)**
- Develop a final report. **(Upcoming)**

2011 Activities: During 2011, staff held the project kick-off meeting and submitted a work plan, project schedule, and a draft background report outline. Stakeholder engagement pre-work was initiated. It was determined that there was no need for institutional review board approval.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: To develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Improvements and Upgrades to the Electronic Preventive Services Selector

Principal Investigator:	McCormack, Lauren
Organization:	Research Triangle Institute (RTI)
Contract Number:	290-09-000211
Project Period:	March 2010 – March 2012
AHRQ Funding Amount:	\$479,032

Summary: In October 2006, the Agency for Healthcare Research and Quality (AHRQ) introduced the Electronic Preventive Services Selector (ePSS), an interactive tool that provides real-time decision support for clinicians as they select preventive services for their patients. The software cross-references patient characteristics, including age, sex, and selected behavioral risk factors, against 110 U.S. Preventive Services Task Force (USPSTF) recommendations covering 59 preventive services topics. The search results rendered at the point-of-care provide a summary of individual patient-specific recommendations, including screening tests, counseling topics, and information on preventive medications. The ePSS was launched initially for use as a Web-based resource available for download to mobile devices using the Palm and Windows Mobile computing platforms. In response to the prevalence of handheld devices in clinical care, subsequent updates to the tool made ePSS available for BlackBerry devices, iPads, and iPhones.

This project is refining and expanding the content and functionalities of the ePSS tool. It provides an opportunity to improve the critical content of the system, particularly in helping providers better engage their patients in discussions of preference-sensitive recommendations and in developing tools and resources requested by health care providers.

A range of formative research methodologies have been used. These include interviews with clinicians, ethnographic observation of clinicians using the tool with patients, and a user survey on facilitators and barriers to ePSS tool use in clinical settings, as well as users' enhancement preferences. Content will be assessed by the following criteria: 1) ability to enhance clinicians' communication with patients about USPSTF recommendations; and 2) ability to increase clinicians' awareness, understanding, and consideration of USPSTF recommendations. The project team is also developing a strategy for seamlessly integrating updated content into the ePSS to ensure a functional product.

Project Objectives:

- Identify and engage a technical expert panel to provide feedback in the research design, findings from the analysis, and final recommendations. **(Ongoing)**
- Conduct formative research with tool users to understand barrier and facilitators to use as well as preferences for enhancements. **(Achieved)**
- Identify, develop, and prioritize a subset of recommendations for new ePSS content. **(Achieved)**
- Develop and test new content and functionality that improves the utility of ePSS with clinicians. **(Ongoing)**

2011 Activities: At the beginning of 2011, RTI, following a plan approved by AHRQ, completed its formative research with clinicians to understand both current use of the ePSS and potential areas and preference for improvements. Research activities included reviewing Web logs of aggregate usage data for the ePSS, interviewing current and new ePSS users (n=9), observing clinicians using the ePSS with patients (n=9), and reviewing responses to custom questions incorporated into a standard AHRQ Web-based customer satisfaction survey deployed on the ePSS site. Based on the findings of the formative research, RTI proposed several key areas for improving ePSS.

- Develop prototype patient handouts that are accessible through the ePSS to support patient decisionmaking on USPSTF recommendations.
- Develop a training module within the ePSS to improve clinicians' skills in communicating about USPTF recommendations, particularly those that are preference-sensitive.
- Provide guidance for integration of the new content into the ePSS and for functionality improvements, particularly in regard to the organization and display of tools and resources provided through the ePSS.

In support of the development of the new content, the project team has engaged in an iterative process involving AHRQ to review draft materials and conduct testing with appropriate audiences.

Impact and Findings: This project has no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

Understanding Development Methods from Other Industries to Improve the Design of Consumer Health Information Technology

Principal Investigator:	Montague, Enid, Ph.D.
Organization:	Westat
Contract Number:	290-09-000231-10
Project Period:	September 2010 – September 2012
AHRQ Funding Amount:	\$409,388

Summary: Consumer health information technology (IT) products, such as those designed for information seeking, retrieval, storage, archiving, and health monitoring, can enhance the quality of health care by empowering consumers to play a more effective, collaborative role in their own care. However, despite the potential power of consumer health IT, health care consumers have been less eager to adopt and use technology than consumers in other industries. According to the literature, a possible reason for the low use rates of consumer health IT products is the lack of robust commercially available tools that recognize the complexity and diversity of personal health information management (PHIM) practices. PHIM practices are influenced by a variety of user and contextual factors, including demographics, attitudes, the user's goals and objectives, and the range of tasks that the user wants to perform.

A project team of staff and consultants from the Center for Health IT at Westat and the Center for Health Information and Decision Systems at the University of Maryland is building upon the [Personal Health Information Management and the Design of Consumer Health Information Technology](#) project, a previous Agency for Healthcare Research and Quality (AHRQ)-funded project. The current project strives to identify methods to develop better-conceived and more widely used consumer health IT. To that end, the project team is conducting an environmental scan and literature review to locate research, tools, methods, opinions, and other material to reveal how methods of other industries might be applied to the design of consumer health IT. A technical expert panel (TEP) will be convened, comprised of leaders in proven product development approaches and methods, to generate insights and innovative ideas related to the design of consumer health IT. Lastly, the team is conducting interviews with people who have expertise in consumer product design in other industries to provide additional perspectives that are generalizable to the design of consumer health IT.

Project Objectives:

- Convene a TEP to bring together leaders in proven product development approaches and methods to generate insights and innovative ideas that are most likely to generalize to the design of consumer health IT. **(Achieved)**
- Conduct an environmental scan and review of relevant grey literature to locate research, tools, methods, opinions, and other material that reveal how the methods of other industries could be applied to the design of consumer health IT. **(Achieved)**
- Conduct key informant interviews to solicit innovative product development approaches that are likely to generalize to the design of consumer health IT. **(Achieved)**
- Develop a set of recommendations to guide consumer health IT vendors and developers in the design of health IT tools. **(Upcoming)**

2011 Activities: The focus of activity in the first half of the year was on planning and preparing for the second TEP meeting, drafting the background report, which included the environmental scan and the literature review, and revising the report based on feedback from AHRQ. The second TEP meeting was held on July 13th. In mid-August, AHRQ received approval from the Office of Management and Budget for the project's data collection activity and the project team designated a set of 15 key informants to interview regarding successful products. TEP members help the project team contact key informants with whom they had a personal relationship. However, there were challenges in confirming interviews with all 15 candidates so the project team worked with AHRQ to identify one potential replacement interview candidates. Because of the delay in completing the interviews, AHRQ approved a contract modification to extend the date for completing the interviews to January 6, 2012. Nine interviews were completed by the end of December 2011, and work began on analysis of the transcripts of these interviews. The third TEP meeting was scheduled for March 7, 2012.

Preliminary Impact and Findings: As a result of the grey literature review and environmental scan, the project team identified and reviewed 18 product development methods and differentiated them on the basis of seven characteristics: structure, iteration, span of approach, user involvement, design team composition, novelty of product, and virtualizability. The team also identified 24 digital consumer products that have achieved marketplace success, which were classified into seven product classes including communication; eCommerce; information storage, archival, and retrieval; personalized entertainment; gaming; learning applications; and smart phones. The core finding was that although there is considerable variety in the design methods used for successful consumer digital products, there are common underlying characteristics that represent best practices in design. The report offers a set of design recommendations for designers of consumer health IT applications.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Structuring Care Recommendations for Clinical Decision Support

Principal Investigator:	Osheroff, Jerry, M.D.
Organization:	Thomson Reuters
Contract Number:	290-09-00022I-2
Project Period:	September 2009 – September 2011
AHRQ Funding Amount:	\$972,665

Summary: Incorporating widely accepted, evidence-based clinical care recommendations (also known as clinical guideline narratives), into clinical decision support (CDS) systems is a key method for improving health care and health outcomes. However, the process of translating such recommendations into “if...then...” logic statements (or rules) in CDS systems is inconsistent and inefficient, with many CDS developers independently translating text-based care recommendations into computer-executable code. Structured, coded clinical logic statements that can be electronically processed can increase the speed, consistency, and efficiency of guideline implementation as CDS rules. Such logic statements would reduce redundancy in extracting and structuring decision logic by assigning computer-interpretable codes to the elements of recommendations, such as inclusion and exclusion criteria for relevant patients and recommended treatment actions. Also, widely accepted formats and approaches for expressing the logic and variables of recommendations could help organizations that develop care recommendations write them in a more easily adapted way for use as automated clinical decision support rules. These rules could be used to trigger helpful clinician reminders and to identify groups of patients who may benefit from particular care interventions, as indicated by evidence-based medicine.

This project developed structured, coded logic statements called “eRecommendations” for all 45 A- and B-graded recommendations of the U.S. Preventive Services Task Force, and 12 recommendations relevant to “meaningful use” measures that, by regulation, must be reported to the Centers for Medicare and Medicaid Services. These eRecommendations leverage standard data elements, coding systems, and value sets developed for performance reporting under Meaningful Use to identify patients for whom a clinical recommendation applies and action should be taken.

Project Objectives:

- Increase use of interventions (e.g., tests, medications, and counseling) for which evidence-based clinical recommendations indicate a clear benefit to patients. An example is routine screening for colorectal cancer in individuals between the ages of 50 and 75. **(Ongoing)**
- Make it easier for clinical information system suppliers (e.g., government agencies and commercial vendors) and implementers (e.g., hospitals and physician practices) to develop and implement automated clinical reminders and related CDS tools based on widely accepted care recommendations. **(Achieved)**
- Produce and populate, with broad stakeholder input, an “eRecommendation” format for expressing clinical recommendations as structured, coded logic statements that are widely useful. This includes leveraging codes and structures used to express clinical performance measures in a computable format to help tighten the measurement and CDS components of the clinical performance improvement cycle. **(Achieved)**

- Leverage the eRecommendation format and project learning to help clinical guideline developers make their recommendations more precise and easier to translate into automated clinical reminders. **(Achieved)**

2011 Activities: The project engaged in activities to examine and enhance eRecommendation use in implementing CDS rules. This included launching a pilot analysis of eRecommendation use in two real world settings; one inpatient (Memorial Hermann Healthcare System), one outpatient (Tulane Community Health Centers). It also included building an expanded “eRecommendation Stakeholder Community” consisting of a cross-section of potential eRecommendation developers and users, and other CDS stakeholders. This community was convened in connection with the pilot site activities to identify next steps for supporting widespread eRecommendation use and value. Furthermore, additional eRecommendations were developed for high priority clinical rules, and two guides were created to facilitate the development and use of eRecommendations.

This project was completed in September 2011.

Impact and Findings: The project team was instructed to develop a method and format for translating clinical recommendations that went as far down the pathway to a machine-executable form as the process could be taken, while still ensuring widespread value from the material. A key component of the resulting eRecommendation method and format was an “implementation considerations” section that navigated the tension between implementers’ need for more setting-specific factors and the vendors’ desire for fewer of these specifics. In addition, the national push for Meaningful Use of health information technology (IT) and related efforts to apply electronic health records to performance measurement and improvement made it desirable to leverage momentum for this and related tools when the methods for structuring care recommendations were developed.

After extensive vetting, broad stakeholder feedback on the eRecommendation work indicated wide interest and a belief that the project materials could deliver significant value for improving the translation of clinical recommendations into CDS rules. The active engagement of this large group of public and private stakeholders in CDS-facilitated healthcare performance improvement is another important project by-product.

This project’s impact also extends to related projects. The Advancing Clinical Decision Support portal project, an Office of the National Coordinator for Health IT (ONC)-sponsored project, may be making eRecommendations available to the public on their portal. An additional ONC-sponsored project, the Strategic Health IT Advanced Research Projects C-2B project, may create an implementer’s workbench to configuring setting-specific factors related to converting eRecommendations into locally-useful CDS rules. This project interplay appears to have stimulated CDS rule development and value that is greater than the sum of the individual projects.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Implementation and Use

Establishing Federal Resources to Support the Patient-Centered Medical Home Concept

Principal Investigator:	Peikes, Deborah, Ph.D., M.P.A.
Organization:	Mathematica Policy Research, Inc.
Contract Number:	290-09-00019I-2
Project Period:	September 2009 – March 2011
AHRQ Funding Amount:	\$1,249,206

Summary: The patient-centered medical home (PCMH) model is a promising strategy for transforming primary care and improving the effectiveness, efficiency, quality, and patient experience of health care. This project supported the Agency for Healthcare Research and Quality (AHRQ) and the Federal government in: 1) developing the PCMH evidence base for researchers and policymakers; and 2) establishing a conceptual framework and communications infrastructure that AHRQ can use to develop recommendations for PCMH design, implementation, and evaluation.

A medical home is not simply a place; it is a model for organizing the delivery of primary health care. AHRQ recognizes the central role of health information technology (IT) in operationalizing and implementing the key features of the medical home. Additionally, AHRQ notes that building a primary care delivery platform that the Nation can rely on for accessible, affordable high-quality health care will require significant workforce development and fundamental payment reform. Without these critical elements, primary care's potential will not be achieved.

Project Objectives:

- Conduct an environmental scan that synthesizes PCMH knowledge and issues in primary care and health policy in order to help policymakers understand emerging PCMH initiatives. **(Achieved)**
- Develop white papers to fill knowledge gaps on PCMH-related topics. **(Achieved)**
- Convene the Federal Collaborative for the Patient-Centered Medical Home to identify relevant Federal and private sector medical home initiatives and how they relate to each other. **(Achieved)**
- Develop a strategic plan to leverage Federal leadership and activity in developing public and private sector work on PCMHs. **(Achieved)**

2011 Activities: The majority of project objectives were achieved in 2010. The focus in 2011 was on developing a final report, including a description of the relevant medical home initiatives and how they relate to each other. The project was completed in March.

Impact and Findings: Over the course of the project, Dr. Peikes and her team convened the Federal Collaborative for the Patient-Centered Medical Home, consisting of 172 members representing 14 agencies and departments. The collaborative builds a common body of knowledge and fosters collaboration among the many Federal agencies that focus on primary care. Throughout this project, experts were convened to advise the project team on the conception and formulation of a series of white papers as well as a list of key foundational articles for decisionmakers.

The white papers focused on topics such as patient engagement, mental health integration, health IT, and the medical neighborhood. The papers were well received by both researchers and policymakers and helped to fill gaps in the conceptualization and understanding of key medical home concepts. In addition to the white papers, other materials were developed to fill knowledge gaps on PCMH-related topics, including:

- A briefing on care coordination in the PCMH.
- A series of decisionmaker briefs.
- A presentation at the 2011 AHRQ Annual Conference on the state of current and future research needs titled, “Patient-Centered Medical Homes: What Do We Know and How Can We Learn More”.
- A scan and assessment of 99 Web sites for content related to the medical home.
- A database of citations listing the leading resources on the medical home, categorized by topic, population, bibliographical information, and keyword.
- A list of foundational articles to help decisionmakers understand the emergence of and latest thinking on the medical home.

In addition to filling knowledge gaps, the papers, briefings, and [PCMH portal Web site](#) provided key information about how the PCMH model of care can achieve the triple aims of improving the health of the population, enhancing the patient experience of care (including quality, access, and reliability), and reducing—or at least controlling—the per capita cost of care. Together with AHRQ, the project team made substantial contributions to the PCMH knowledge base, building a solid foundation for continued work in this field.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

Improving Electronic Health Records Patient Education Materials

Principal Investigator:	Shoemaker, Sarah J., Pharm.D., Ph.D.
Organization:	Abt Associates, Inc.
Contract Number:	290-09-00012I-4
Project Period:	July 2010 – July 2013
AHRQ Funding Amount:	\$524,945

Summary: Health literacy refers to an individual's ability to read, understand, and use health care information to make decisions about treatment. An estimated 90 million people in the United States have limited health literacy. A low level of patient health literacy can undermine communication between physician and patient, resulting in substandard care. Therefore, health literacy must be a factor in health information and patient educational materials design to help patients get better care.

Abt Associates, in partnership with colleagues at the Mongan Institute for Health Policy at Massachusetts General Hospital (MGH) and Northwestern University's Health Literacy and Learning Program (HeLP), is leading a study to develop a rating system to assess whether patient education materials delivered by electronic health records (EHRs) are written in a way that is sufficiently understandable for patients to make relevant decisions and take action. A technical expert panel (TEP) has been established as a resource for expertise and guidance into the development of the Health Information Rating System (HIRS) and other project tasks.

MGH is leading the review of current EHR patient education capabilities and features. Utilizing the developed rating system, an environmental scan is being conducted to compile an inventory of understandable and actionable health information materials. Finally, the Abt team will inform EHR vendors and users of their findings on patient education capabilities and features. The team will also disseminate the new rating system and inventory high-quality materials.

Project Objectives:

- Develop a scale to rate the understandability and actionability of health information or patient education materials provided via EHRs. **(Ongoing)**
- Complete an environmental scan and develop an inventory of publicly available patient education materials that rate well on the new scale. **(Ongoing)**
- Review current EHR patient education capabilities and features. **(Achieved)**
- Educate EHR vendors and users about the need for and availability of appropriate education materials. **(Ongoing)**

2011 Activities: Activities focused on developing the HIRS by drawing from existing instruments, evidence, and the TEP. The project team has also executed the review of current patient education capabilities and features. Face and content validation of the rating system were established under the guidance of the TEP. Plans for reliability testing were established. MGH completed the review of current EHR patient education capabilities and features.

Preliminary Impact and Findings: This project has no findings to date.

Target Population: Low Literacy

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

PCMH Resource Center Public and Private Web Portals

Principal Investigator:	Syed, Dani
Organization:	Booz Allen Hamilton
Contract Number:	290-09-00005I-3
Project Period:	September 2009 – September 2012
AHRQ Funding Amount:	\$250,000

Summary: The patient-centered medical home (PCMH) model has the potential to transform the delivery of primary health care by providing preventive services and coordinated, team-based care that follows patients through treatment settings and episodes. The Agency for Healthcare Research and Quality (AHRQ) is investing in the development of an infrastructure to further public understanding of PCMH and the role of health information technology (IT), including implications for provider payment, patient education, provider organization and workflow, and quality reporting. The PCMH concept has been embraced by a variety of stakeholders within the health care system. National physician organizations, consumer organizations, disease advocacy organizations, employers, and payers all have endorsed PCMH as a way to provide care that meets the Institute of Medicine’s dimensions of quality: safe, effective, patient-centered, timely, efficient, and equitable. With its intuitive approach of coordinating care from the perspective of the patient rather than that of the delivery system, and its emphasis on a team of clinicians working in partnership with patients and families to achieve positive outcomes, the PCMH presents a model of care that can realize the goals of many different stakeholders.

Through its Health IT Portfolio, the Prevention and Care Management Portfolio, and the Center for Primary Care, Prevention, and Clinical Partnerships, AHRQ is exploring the potential of PCMH models to improve the quality, safety, effectiveness, and efficiency of primary care services. AHRQ is investing in research, white papers, implementation tools, collaborative meetings, and other activities related to primary care transformation. Additionally, AHRQ is leading the development of a conceptual infrastructure for supporting and publicizing patient-centered medical home initiatives and efforts undertaken by the Federal government.

The overall aim of this project is to assist AHRQ in providing the IT infrastructure and support for a public Web portal to aid the dissemination of information about PCMH activities, research, and outcomes, and a private Web portal to facilitate the collaboration of the Federal working group on the primary care redesign efforts.

Project Objectives:

- Provide on-going support to both the public and private portals. **(Ongoing)**
- Update citations database with latest data on both the public and private portals. **(Ongoing)**
- Develop citations administrative module. **(Achieved)**
- Review prototype-level tool. **(Achieved)**
- Develop a Department of Defense and Veterans Affairs collaboration page. **(Ongoing)**
- Develop PCMH private portal membership directory. **(Achieved)**
- Provide PCMH private portal updates. **(Ongoing)**

2011 Activities: The project team completed the following activities in 2011:

- **PCMH support form:** The team continued to manage an issue and ticket management system support form to both public and private portals to facilitate and track email communications regarding portal work products.
- **PCMH citations database update:** The latest PCMH citations database has migrated to the public and private portals. All current data migrations can be done directly through the PCMH citations administrative module on the live site.
- **PCMH public portal re-design:** The team significantly redesigned the public portal to support new content areas including white papers, meeting materials, and multimedia resources such as meeting and conference videos and audio presentations. The content is continually updated to increase value to users.

Preliminary Impact and Findings: There are no findings to date.

Target Population: General

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Synthesis and Dissemination

Patient-Centered Medical Home Information Model

Principal Investigator:	Waldren, Steven, M.D., M.S., A.A.F.P.
Organization:	Westat
Contract Number:	290-09-000231-6
Project Period:	August 2010 – August 2011
AHRQ Funding Amount:	\$286,513

Summary: Currently, there is no standard definition or description of a patient-centered medical home (PCMH). Although descriptions may consist of sets of principles associated with the PCMH concept, the way PCMH core principles relate to the actual experiences of patients and providers within a PCMH is not clearly understood.

Dr. Steven Waldren and a study team from Westat developed a framework that links core principles and attributes of a PCMH to clinical activities and experiences (e.g., information flows) of patients within a PCMH. This framework can organize the elements of a PCMH, understand their relationships, and examine the information flows within and beyond the PCMH. By describing a set of clinical activities and experiences that are needed to support the PCMH, the framework can also guide the development of PCMH information systems.

Patients, clinicians, and others with an interest in PCMH can use this framework to better understand the effect of the principles found in PCMH literature on specific attributes and real-life experiences of patients within a PCMH. The framework also provides a prism on the details of interactions and flow of information within and outside the PCMH. Although further work is necessary to clarify the definitions of principles and attributes and to associate attributes with specific principles, this framework provides an approach to identifying the attributes of an existing PCMH and its potential for change.

Project Objectives:

- Conduct a comprehensive literature review into the various interactions a patient has within a patient-centered medical home. **(Achieved)**
- Convene an expert panel to obtain key stakeholder input on development of the PCMH information model. **(Achieved)**
- Convene working groups and focus groups for the purpose of model validation. **(Achieved)**
- Develop non-technical narrative and technical reports to describe the PCMH information model. **(Achieved)**

2011 Activities: Activities were focused on developing the information model and validating it through the expert panel, working groups, and focus groups. The project was completed in August 2011.

Impact and Findings: Through a series of nine patient scenarios, the project team constructed a common framework of what the PCMH is and is not, focusing on 44 of the 59 possible PCMH attributes that are thought to improve quality, lower cost, or differentiate the PCMH. The patient scenarios are used in the final report of the project to describe the potential interactions and information flows in a PCMH-supported health care ecosystem. These scenarios show how the shared PCMH principles can be realized

using current resources and technologies, and how the principles should be continuously updated to reflect best practices as new technologies and approaches are added to the practice of medicine.

The scenarios are broken into the following categories:

- Interactions Focused on PCMH and Patient:
 - Childhood Acute Illness
 - Adult Acute Illness
 - Adult Acute Illness (with different PCMH attributes)
- Interactions Focused on PCMH and Subspecialty Care:
 - Childhood Acute Illness
 - Adult Prevention
 - Adult Chronic Disease
- Interactions Focused on PCMH and Inpatient Care:
 - Young Adult Acute Illness
 - Senior Chronic Disease
 - Senior Acute Illness

Although the nine scenarios presented as a result of this project cover many of the attributes of the PCMH, the project team acknowledges that they do not describe all the information flows and interactions that characterize the PCMH. Further validation of the scenarios with providers and patients is warranted, and additional scenarios to refine the definition of the PCMH are needed. One of the limitations of this work is the lack of formal definitions of PCMH attributes in the literature. Obtaining consensus among the PCMH community on key performance indicators and goals of each PCMH attribute would facilitate evaluation of the scenarios and the extent to which they fully represent the PCMH attributes.

Target Population: Adult, Elderly*, Pediatric*, Teenager

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

** This target population is one of AHRQ's priority populations.*

The Give Teens Vaccines Study

Principal Investigator:	Fiks, Alexander, M.D., M.S.C.E.
Organization:	The Children's Hospital of Philadelphia Pediatric Research Consortium
Contract Number:	290-07-10013-4
Project Period:	September 2009 – March 2012
AHRQ Funding Amount:	\$500,000

Summary: Immunization rates were designated as one of the leading health indicators for the Nation by Healthy People 2010. They are particularly useful as measures of the quality of pediatric care because immunization schedules are clearly delineated, nationally standardized, and structured to protect children and adolescents from life-threatening illnesses. While historically much attention has been focused on the immunization of infants and young children, recent licensing of new vaccines for adolescents has broadened the population that requires timely vaccination. However, effectively delivering adolescent vaccines, especially the quadrivalent human papillomavirus (HPV) vaccine, has been challenging. According to a recent National Immunization Survey, rates of HPV vaccination are the lowest of all adolescent vaccines.

The Children's Hospital of Philadelphia (CHOP) Pediatric Research Consortium (PeRC) is evaluating the impact of clinician-focused and patient/family-focused health information interventions on HPV vaccination rates among adolescents. The PeRC network serves as an integrated pediatric care delivery system, with shared administrative structure and a shared state-of-the-art electronic health record (EHR). This study is comparing the effectiveness of targeting immunization decision support at families versus clinicians by conducting two parallel trials: a cluster-randomized trial aimed at clinicians, and a family-level randomized trial. The planned intervention employs multiple evidence-based strategies to influence HPV vaccine delivery and receipt in primary care. For clinicians, these include education, clinical decision support, audit, and feedback on vaccination success measured as the proportion of eligible patients seen by a clinician and given the vaccine during each month of the study. Family-focused decision support reminds parents and their adolescent child that the vaccine is due through phone calls that provide educational information on the vaccine, and offer links to additional information on a Web site designed for this project that combines content available through the CHOP Vaccine Education Center.

The evaluation of these two distinct approaches will provide information on the impact of these alternate strategies, alone or in combination, on HPV vaccination rates. The study will advance understanding of how to use health information technology to engage adolescents and families with clinicians in health decisions, and will inform future interventions aimed at improving health for children and adolescents.

Project Objectives:

- Conduct a qualitative study to better understand decisionmaking at the point of care and generate hypotheses to inform interventions to increase vaccine receipt. **(Achieved)**
- Test the benefit of clinician-directed versus family-directed decision support, delivered using the EHR, on receipt of HPV (primary outcome) and other vaccines for adolescent girls. **(Achieved)**

- Assess the acceptability of this intervention among parents and its effect on HPV vaccine communication and decisionmaking. **(Ongoing)**

2011 Activities: The focus of activity was on placing reminder calls to parents; providing vaccine alerts to clinicians; and delivering quarterly feedback reports to clinicians at intervention sites with the rates of captured immunization opportunities for each provider and practice and the entire care network. In addition, a survey was conducted as part of a nested cohort study to understand in greater detail the impact of the decision support interventions on families and their decisionmaking process. Data collection and analysis of this survey has been completed.

Results of the pilot study conducted in 2010, involving interviews with 20 parent-clinician-adolescent triads, were presented at the annual meeting of the Pediatric Academic Societies in April 2011. Dr. Fiks also presented these results at the International Shared Decision Making meeting in the Netherlands in June 2011.

An article titled “[HPV vaccine decision making in pediatric primary care: a semi-structured interview study](#)” was published in *BMC Pediatrics* in November 2011, discussing the qualitative sub-study of clinicians, mothers, and adolescent girls. The contract was extended by 6 months and will now end in March 2012. The project team will use this time to develop a manuscript on the progress of the clinical trial.

Preliminary Impact and Findings: For HPV doses 1, 2, and 3, the combined family and clinician decision support intervention was the most effective, shortening time to receipt of each dose by 151, 68, and 93 days and increasing vaccination rates by 9 percent, 8 percent, and 13 percent, respectively, compared to no intervention. The clinician-focused intervention was superior to the family-focused group for HPV dose 1, but inferior for doses 2 and 3. The intervention had little effect on Tdap (tetanus, diphtheria, and acellular pertussis vaccine) and MCV (meningococcal vaccine).

Target Population: Pediatric*, Teenagers

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to improve health care decisionmaking through the use of integrated data and knowledge management.

Business Goal: Knowledge Creation

* *This target population is one of AHRQ's priority populations.*

Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions Between Care Settings

Principal Investigator:	Krist, Alexander H., M.D., M.P.H.
Organization:	Virginia Commonwealth University
Contract Number:	290-07-10011-3
Project Period:	September 2009 – March 2012
AHRQ Funding Amount:	\$499,982

Summary: There is a major discrepancy between the American public’s perceived value of personal health records (PHRs) and the actual use of PHRs. This less-than-optimal use of health information technology (IT) occurs at a time when the Nation is looking at health IT as an essential tool to reform health care, improve quality of care, coordinate care delivery, and reduce costs. For small- to medium-sized primary care practices implementing health IT, financial and technical resource limitations often require the adaptation of technology that is already available.

This project is assessing methods of creating PHRs from existing electronic medical record (EMR) systems at small- to medium-sized primary care practices. For this project, a PHR is defined as a nonproprietary, prevention-focused patient record. When integrated with a clinician’s EMR, it is termed an “interactive preventive health care record” (IPHR). The IPHR called MyPreventiveCare incorporates clinical decision support software, a reminder system, tailored educational materials, and decision aids into one package for patients and clinicians. A previous study showed IPHRs to enhance clinician-patient communication and increase the delivery of recommended preventive services by 3-to-12 percent. The current study builds on those findings to evaluate whether the IPHR can be applied in health care settings that use different EMRs.

The study is being conducted in six practices that use Epic or A4 EMRs and cover a range of service areas (rural, suburban, and urban), and sizes (from two-to-10 clinicians). Through a series of learning collaboratives, study staff are guiding practices to create a shared vision for IPHR implementation. Separate learning collaboratives are being conducted at each practice before and after IPHR implementation. The study team is working toward eight components to help engage practices and create change: 1) securing leadership buy-in and support; 2) creating a culture that is conducive to change; 3) establishing a sense of priority; 4) forming a guiding coalition; 5) developing and communicating a shared vision; 6) empowering members to act on the vision; 7) planning for short-term wins; and 8) consolidating and institutionalizing improvements.

Project Objectives:

- Determine whether the study sites can begin implementing the IPHR. **(Ongoing)**
- Measure the utilization and effectiveness of the IPHR. **(Ongoing)**
- Determine the necessary steps and procedures that practices need to follow or avoid in order to implement the IPHR successfully. **(Ongoing)**

2011 Activities: All core programming tasks, including the addition of laboratory functionality, were completed. The seventh learning collaborative was completed. MyPreventiveCare continues to be utilized by the six study sites and all wish to do so indefinitely. The research team completed the formal observation of all study sites. The contract was extended due to delays in site implementation to provide additional time to obtain post-implementation EMR datasets from all of the study sites. This was a substantial data query that included information about all patients in the past 2 years at the six study sites. The process of cleaning the data for formal analysis was initiated.

All of the collaboratives' audio recordings were transcribed and site observation field notes were compiled for every site. Transcripts were coded for the qualitative analysis. The research team completed a draft implementation guide.

Extensive dissemination activities, including presentations to the Virginia Commonwealth University Health IT Committee, the Agency for Healthcare Research and Quality Practice Based Research Network Annual Conference, Centers for Disease Control and Prevention's public forum discussion on Development of a Health Risk Assessment Guidance, and National Institute of Health and the Society of Behavioral Medicine. Additional manuscripts are being developed and published.

Preliminary Impact and Findings: All six practices were able to adopt the IPHR and begin offering it to patients. The six practices had varying rates of IPHR utilization. One site had 22.2 percent of patients using the IPHR over a 15-month implementation period, while another had only 0.8 percent of patients using the IPHR over a 9-month implementation period. The project observed statistically and clinically greater increases in colon and cervical cancer and cholesterol screenings and tetanus vaccinations for IPHR-users compared to non-users 4-months after an office visit. Factors associated with increased patient use of the IPHR included multiple staff members talking to patients about the IPHR during a visit; nurses rather than clinicians primarily engaging patients; local leadership buy-in; and a clear understanding of the IPHR's functionality among staff. Confusion and competing demands from fielding multiple patient portals significantly limited practices' ability to get patients to use the IPHR.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Using Health Information Technology to Improve Health Care Quality in Primary Care Practices and in Transitions between Care Settings

Principal Investigator:	Mold, James, M.D., M.P.H.
Organization:	University of Oklahoma Health Science Center
Contract Number:	290-07-10009-5
Project Period:	September 2009 – September 2012
AHRQ Funding Amount:	\$332,000

Summary: A fundamental feature of a national health care network is the ability to share electronic health records (EHRs) from local health information exchange (HIE) hubs through regional health information organizations (RHIOs). A major barrier to RHIO use, however, is the lack of a convincing value proposition for providers. While there appears to be a net societal benefit from investments in sharing information among health care organizations, the return on investment for individual medical practices—especially smaller practices—is less certain. Medical practices incur most of the costs of adopting new information sharing technology, while health insurers and patients receive most of the benefits. Apart from capital expenses and fees, medical practices must adapt their workflow to benefit from RHIO technology. Many medical practices lack managers with the necessary implementation skills and experience. There is scant research on which specific features of existing RHIOs are most useful in primary care, what new features are needed, and how these features can be incorporated into primary care workflow and care processes.

This project documents, studies, and reports the engagement of six primary care practices that use EHRs and are linked through a local HIE hub in a RHIO called Secure Medical Records Transfer Network (SMRTNET). SMRTNET provides access to a broad range of information—including hospital records, laboratory tests, pharmacy records, and a statewide immunization registry—from a variety of sources. As part of this project, SMRTNET was enhanced with the Web-based Preventive Services Reminder System (PSRS), a comprehensive clinical tool for improving the delivery of patient-centered preventive services through a patient registry, prompt/reminder functionality, clinical decision support, and quality improvement (audit) functions that are accessible through a simple, secure Web interface.

The project tests the usefulness and acceptability of a RHIO's ability to promote HIE across both local and statewide health care systems as a single point of attachment (i.e., a single interface rather than separate interfaces for multiple EHR systems) for the PSRS software application. While many aspects of this HIE infrastructure development are specific to the two systems being studied, the research team believes that this type of connection between HIE systems and RHIOs is likely to be implemented throughout the United States. Analysis of the results of this implementation will yield generalizable and useful knowledge about best practices for HIE facilitation of patient-centered care in primary care provider settings. Furthermore, the research team anticipates that Federal incentives, funding, penalties, and requirements under the American Recovery and Reinvestment Act of 2009's Meaningful Use standards will accelerate the combined use of EHRs and RHIOs.

Based on observations and data analysis, the study team will produce an implementation guide to

disseminate this type of health information technology system to other practices, at least one published manuscript reporting their findings, and a final report. The plan for disseminating the technology to primary care practices will be developed in collaboration with the Agency for Healthcare Research and Quality.

Project Objectives:

- Enhance the current features of SMRTNET by including the PSRS software program. **(Achieved)**
- Test the usefulness and acceptability of the technology intervention. **(Ongoing)**
- Develop an implementation guide that provides the principles and steps required to implement connections between such systems and documents potential benefits from and barriers to implementation. **(Ongoing)**

2011 Activities: There were delays in developing PSRS interfaces with eClinicalWorks and SMRTNET. After meeting with software vendors, substantial progress in the SMRTNet-eClinicalWorks hub connection and some progress on SMRTNET-PSRS connection was made. The SMRTNet-eClinicalWorks hub connection is operational. Significant progress was made in establishing the SMRTNET-PSRS connection. By the end of 2011, most of the software issues had been corrected and providers were re-oriented to the PSRS and SMRTNET access from the eClinicalWorks interface. Because of these delays, the contract was extended by 12-months to complete the project and will end in September 2012.

Preliminary Impact and Findings: The project has no findings to date.

Target Population: Not Applicable

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Evaluation of Computer-Generated After-Visit Summaries to Support Patient-Centered Care

Principal Investigator: Pavlik, Valory, Ph.D.
Organization: University of New Mexico
Contract Number: 290-07-10007-2
Project Period: September 2009 – March 2012
AHRQ Funding Amount: \$496,788

Summary: The office visit remains a cornerstone of primary care and health information delivery. Yet studies have shown that by the time the patient leaves a facility, he or she may forget as much as 50 percent of the information relayed during the visit, which can negatively affect a patient's care.

Electronic medical records (EMRs) offer a new method of providing patients with information about their clinical visits through personalized, patient-specific handouts that summarize the topics and recommendations covered during the visit. These after-visit summaries (AVS) have the potential to improve a patient's retention of information about adherence to treatment plans and followup instructions. AVS can also facilitate the transfer of information between health settings. However, the content and formatting of AVS that will optimize patients' information retention and satisfaction is still unknown.

Through a contract with the University of New Mexico, Dr. Valory Pavlik and her team from the Baylor College of Medicine, Department of Family Practice provided expertise and guidance throughout the term of the project.

This project employed qualitative methods to gather patient and physician input into AVS development. The research team then developed three AVS versions with varying amounts of included information. The three experimental versions were evaluated in a randomized trial to examine the effects of differences in information content on patient recall and satisfaction. A fourth group of patients received the standard AVS used in each clinic. The study took place in four clinics in Texas that use the EpicCare EMR and serve an ethnically and socioeconomically diverse patient population. The research team included experts in study design and analysis, medical informatics, bilingual and bicultural patient information transfer, qualitative analysis, and clinical practice-based research.

The research team will draft and submit a manuscript about the research effort to a peer-reviewed journal and will propose processes for dissemination, including publicity through primary care organizations, academic primary care departments, practice associations, and various organizations active in health information technology (IT) development. Technical findings and after-visit summary-related products will be available for download on the Internet for use by other primary care providers. The team will prepare a final report that includes all study deliverables (e.g., copies of all research instruments), results, conclusions, suggestions for additional research, and actionable lessons learned.

Project Objectives:

- Ascertain patient attitudes, preferences, and needs regarding the delivery of information at a visit with a primary care physician. **(Achieved)**

- Identify primary physicians' attitudes about the utility, content, and value of the AVS. **(Achieved)**
- Develop and test three different versions of an AVS. **(Achieved)**
- Prepare an implementation guide to assist practices in developing and implementing an AVS. **(Ongoing)**

2011 Activities: During the year, the research team reviewed a summary of key themes from patient and physician interviews that pertain to AVS format and content, and developed three different prototype AVS forms. Issues related to facilities, extreme weather, personnel, and information technology have slowed patient recruitment, but recruitment and data collection will be completed by March 2012.

Preliminary Impact and Findings: The research team completed data collection at the Baylor Family Medicine (BFM) clinic, Houston Service Workers Clinic (HSWC), and Harris County Hospital District (HCHD) Martin Luther King clinic. Fifty-six patients were recruited at BFM, 48 of whom received the first call-back and eight of whom missed it. Thirty-nine received the second call-back while nine were lost to followup. Eighteen patients declined to participate. At HSWC, 77 patients were recruited. Sixty-eight received the first call back and nine missed it. Fifty-three received the second call-back and 15 were lost to followup. Twelve patients refused to participate. At HCHD, 51 patients were recruited. Forty-eight received the first call-back, three missed it. Thirty-nine received the second call-back and nine were lost to followup. Ten patients refused to participate.

Study staff was in the process of collecting data at the Harris County Hospital District, Strawberry clinic. Their goal is 40 English-speaking and 68 Spanish-speaking patients. By the end of 2011, their results included:

- English-speaking patients: Forty-four patients were recruited. Thirty-eight received the first call-back and zero missed it. No patients received the second call-back and none were lost to followup. Eight patients declined to participate.
- Spanish-speaking patients: Fifty-four patients were recruited. Forty-nine received the first call-back; zero missed it. No patients received the second call-back and none were lost to followup. Six patients declined to participate.

Target Population: Adults

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions in care settings, and the use of electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

Assessing the Impact of the Patient-Centered Medical Home

Principal Investigator:	West, David, Ph.D.
Organization:	University of Colorado Health Science Center
Contract Number:	290-07-10008-6
Project Period:	July 2009 – February 2011
AHRQ Funding Amount:	\$249,876

Summary: A research team from the University of Colorado Health Sciences Center and the Robert Graham Center evaluated clinical outcomes, financial and economic impact, and patient and provider satisfaction for WellMed Medical Group. WellMed is a medium-sized primary care health system that, over the past 20 years, has implemented a patient-centered medical home (PCMH) as defined by the National Committee for Quality Assurance. The study examined outcomes and cost-effectiveness of the PCMH model implemented amongst WellMed's 22 practices and 80 providers. The evaluation focused on overall care; care for specific diseases such as coronary artery disease, diabetes mellitus, and chronic obstructive pulmonary disease; and preventive care, including adult immunizations.

The study team used a mixed-method qualitative and quantitative evaluation approach. Key informant interviews and participant observations helped the study team understand how WellMed developed its model of care over time, the critical organizational milestones on the road to becoming a PCMH, and what it means to WellMed to be a PCMH. These qualitative data provided a narrative foundation that complemented and informed the quantitative findings. Data collection focused on the strategic changes made to improve health outcomes for different conditions. Health outcome measures included clinical outcome test values, hospitalization rates, and mortality rates. Particular attention was given to the associated effects of specific elements of the medical home model, including care management, team-based care characteristics, and health information technology (IT) functions.

A trend analysis assessed the impact of PCMH-related interventions on patient and provider satisfaction. In addition, a detailed analysis of the data assessed the impact of the WellMed PCMH on patient care and health outcomes over a period of 10 years (1997-2006), comparing the full claims data available during various blocks of time with similar patient panels. Purposeful implementation of a comprehensive patient data management system allowed for internal and external cohort analyses.

Specific Aims:

- Determine how WellMed developed their level-3 PCMH model (facilitators, barriers, key components, history, and leadership) using a qualitative methods approach. **(Achieved)**
- Determine if implementation of the WellMed model impacted patient and provider satisfaction. **(Achieved)**
- Determine if implementation of the WellMed level-3 PCMH improved care and health outcomes for patients. **(Achieved)**
- Determine the incremental in-practice expenses per patient per month required to operate the WellMed PCMH, and key components of the program. **(Achieved)**

2011 Activities: The quantitative comparison analysis was completed in 2010 and the first of four

studies, [Case Study of a Primary-Care Based Accountable Care System Approach to Medical Home Transformation](#), was published in the January 2011 *Journal of Ambulatory Care Management*. This manuscript reported that WellMed patients older than 65 had an adjusted mortality rate that was half of the statewide average. Hospitalization and readmission rates and emergency department visits had not changed over time, but preventive services improved. The authors concluded that phased implementation across the network made it difficult to link improvements to specific processes, but they seem to improve outcomes collectively.

Three additional papers were finalized in 2011, including: 1) *A Cohort Analysis of Medicare Beneficiaries in a Primary Care-based Accountable Care Organization vs. Medicare Fee-for-service*; 2) *A 20-year Evolving Patient-Centered Medical Home–Based Accountable Care Organization that Works for Older Americans*; and 3) *The Economics of a Primary Care-based Accountable Care Organization*. Publication of these papers is pending. The final analyses were also presented as part of an invited panel at Academy Health in June 2011.

The contract was extended for 6 months, during which a significant portion of the manuscript development occurred. The project was completed in February 2011.

Impact and Findings: This study found that WellMed, Inc., a primary-care based accountable care organization (ACO), produced clinical, financial, and utilization outcomes that are demonstrably better than matched cohorts of fee-for-service Medicare patients. This evaluation demonstrated that a 40-50 percent increase in investment in primary care over typical Medicare payments—up to 10 percent of total health care spending and investment in a sophisticated array of support services—can produce impressive savings, largely by reducing inpatient admissions and bed days. The specific reductions in emergency and inpatient services, particularly of bed-days, produce considerable return on investments in outpatient care, disease, and complex-care management; intensive clinical data monitoring and related quality feedback loops; and unusual services designed to solve costly patterns of care. WellMed also pays primary care providers more than twice as much as the national average, much of it through incentives that are large enough to shape behavior. The hospital used by WellMed generally reported larger margins than are typical of Medicare, but does not share in the broader savings, allowing more to be reinvested in outpatient services or shared as profit to outpatient team members.

This study supports findings from other ACO experiments and offers another model for reaping the fuller fruits of primary care. It also suggests a need to better understand the IT needs associated with population health management. WellMed demonstrated the need to have broader data-capture than clinical electronic health record systems; sophisticated analytic and feedback capacity (for quality improvement and intervention evaluation); and capacity for sharing data securely in a variety of ways, perhaps most importantly for patients to carry their key information electronically.

Target Population: Chronic Care*, Chronic Obstructive Pulmonary Disease, Diabetes, Heart Disease

Strategic Goal: Develop and disseminate health IT evidence and evidence-based tools to support patient-centered care, the coordination of care across transitions, and the electronic exchange of health information to improve quality of care.

Business Goal: Knowledge Creation

* This target population is one of AHRQ's priority populations.

Appendix A – AHRQ Offices and Centers and Portfolios

Offices and Centers

AHRQ, part of the U.S. Department of Health and Human Services (DHHS), is the lead agency charged with supporting research designed to improve the quality of health care, reduce its cost, and broaden access to essential services. AHRQ's wide array of research brings practical, science-based information to medical practitioners, consumers, and other health care purchasers. The Agency is comprised of nine major Offices and Centers:

- **[Center for Delivery, Organization, and Markets \(CDOM\)](#)**: CDOM is a locus of expertise and leadership for research on health care markets, delivery systems, and organizations.
- **[Center for Financing, Access, and Cost Trends \(CFACT\)](#)**: CFACT conducts, supports, and manages studies of the cost and financing of health care, access to health care services, and related trends. CFACT's studies and data development activities support policy and behavioral research by providing health care leaders and policymakers with information and tools to improve decisions on health care financing, access, coverage, and cost.
- **[Center for Outcomes and Evidence \(COE\)](#)**: COE conducts and supports research and assessment of health care practices, technologies, processes, and systems.
- **[Center for Primary Care, Prevention, and Clinical Partnerships \(CP3\)](#)**: CP3 expands the knowledge base for clinical providers and patients and ensures the translation of new knowledge and systems improvement into primary care practices. CP3 supports and conducts research to improve the access, effectiveness, and quality of primary and preventive health care services.
- **[Center for Quality Improvement and Patient Safety \(CQuIPS\)](#)**: CQuIPS improves the quality and safety of all Americans through strategic partnerships and collaborations with stakeholders across the health care system to implement evidence-based practices.
- **[Office of Communications and Knowledge Transfer \(OCKT\)](#)**: OCKT promotes the communication of information to both internal and external customers. It designs, develops, implements, and manages programs for disseminating and implementing the results of Agency activities that have the goal of changing audience behavior.
- **[Office of the Director \(OD\)](#)**: OD directs the research, research training programs, and dissemination activities of AHRQ to ensure the achievement of strategic objectives.
- **[Office of Extramural Research, Education, and Priority Populations \(OEREP\)](#)**: OEREP directs the scientific review process for grants and Small Business Innovation Research contracts, manages Agency research training programs, evaluates the scientific contribution of proposed and ongoing research, demonstrations, and evaluations, and supports and conducts health services research on priority populations.
- **[Office of Performance, Accountability, Resources, and Technology \(OPART\)](#)**: OPART directs and coordinates Agency-wide program planning and evaluation activities and administrative operations.

Portfolios

In addition to the Offices and Centers, AHRQ supports a series of interrelated health services research programs that individually and collectively seek to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. In 2011, all funded projects were organized into six AHRQ Portfolios: Health IT, Comparative Effectiveness, Innovations and Emerging Issues, Patient Safety Research, Prevention and Care Management, and Value Research.

- **Health IT:** The primary focus of this Portfolio is to identify challenges to health IT adoption and use, solutions and best practices for making health IT work, and tools that will help hospitals and clinicians successfully incorporate new health IT.
- **Comparative Effectiveness:** The goal of this Portfolio is to support high-quality research to help patients, health care providers (including nurses, doctors, and other clinicians), and policymakers to make evidence-based health decisions.
- **Innovations and Emerging Issues:** This Portfolio focuses on identifying and supporting novel research that spans a diverse array of disciplines and has the potential to accelerate improvements in the organization, delivery, and management of health care.
- **Patient Safety Research:** The primary focus of this Portfolio is to produce research on the scope and impact of medical errors, the root causes of threats to patient safety, and effective ways to make system-level changes to help prevent errors.
- **Prevention and Care Management:** The objective of this Portfolio is to translate evidence-based knowledge into current recommendations for clinical preventive services that are implemented as part of routine clinical practice to improve the health of all Americans, and to research approaches to improve care and reduce disparities for common chronic conditions such as diabetes, asthma, and heart disease.
- **Value Research:** This Portfolio aims to facilitate research related to the Value-Driven Healthcare Initiative and the Health Insurance Decision Tool, which provides an integrated set of decision tools to assist States in the development of innovative programs that are consistent with the President's goal to provide basic health insurance at an affordable price.

Appendix B – History of AHRQ-Sponsored Funding Opportunities

AHRQ's Health IT Portfolio has consisted of three major grant funding initiatives: the now-closed Transforming Health Care Quality through Information Technology request for applications (RFAs), the Ambulatory Safety and Quality RFAs, and most recently, the Health IT Program Announcements. These funding initiatives are described below, followed by the history of other AHRQ-Sponsored Health IT Funding Opportunity Announcements (FOAs) and Special Emphasis Notices (SENs).

Transforming Health Care Quality through Information Technology (THQIT) RFAs.

Beginning in 2004, the THQIT program supported different aspects of organizational and community-wide health IT implementation-related activities. The goal of the program was to elucidate various stakeholders' perspectives and demonstrate the value of health IT implementation and use, particularly in rural hospitals and community-based health care settings. All of the grants in this category were awarded through RFAs that are now closed. The THQIT initiative included 118 grants funded through the following four RFAs:

- ***THQIT Planning Grants (P20, HS-04-010):*** Designed to support the planning and development phases of health IT infrastructure for communities interested in preparing for effective exchange of health information across multiple community health care organizations. All 38 THQIT planning grants were completed by end of 2006.
- ***THQIT Implementation Grants (UCI, HS-04-011):*** Intended to assess the extent to which health IT implementation contributes to measurable and sustainable improvements in patient safety, cost, and overall quality

of care. All 40 implementation grants were completed by 2009.

- ***THQIT Implementation Grants II (UCI, HS-05-013) (this was limited competition among the 38 awardees of the Planning Grants):*** Designed to serve as implementation grants for institutions that had received and completed a planning grant. All implementation II grants were completed by 2010.
- ***THQIT Value Grants (R01, HS-04-012):*** Intended to generate insight from various stakeholders' perspectives on direct and indirect benefits when health IT is used in the delivery of health care, including those related to clinical outcomes, safety, quality, cost savings, effectiveness, and efficiency. All 24 value grants were completed by 2009.

Ambulatory Safety and Quality (ASQ) RFAs.

The ASQ initiative, established in 2007, supported grants to improve the safety and quality of ambulatory health care in the United States. The five components of the ASQ initiative were: 1) risk assessment in ambulatory care, 2) improving quality through clinician use of health IT, 3) enabling patient-centered care through health IT, 4) enabling patient safety and quality measurement through health IT, and 5) improving management of individuals with complex healthcare needs through health IT. All of the grants in this category were awarded through RFAs that are now closed. The ASQ initiative included 69 grants funded through the following four RFAs:

- ***Enabling Patient-Centered Care (PCC) Through Health IT RFA (HS-07-007):*** Designed to investigate novel methods or evaluate existing strategies for using health IT to create or enhance patient-centered

models of care in the ambulatory setting. Patient-centered care is responsive to the needs and preferences of individual patients, provides patients with access to their medical information, and empowers patients to be active participants in care decisions and in the daily management of their health and illnesses. Grantees were expected to demonstrate how patient-centered care can improve health outcomes, patient safety, and patients' reported experience with care. Projects focused on shared decisionmaking; patient-clinician communication; providing patients, their families, and/or clinicians access to patient's medical information across transitions in care; and/or patient self-management of chronic conditions. This initiative also included set-aside funding for projects that focused on medication management, which worked with Practice-Based Research Networks, or that focused on vulnerable populations and the care settings that serve them. Sixteen total grants were awarded in 2007. Fourteen of these grants were active in 2011, all using no-cost extensions. Thirteen of these projects ended in 2011; the remaining grant received a second 1-year no-cost extension and is scheduled to end in 2012.

- ***Improving Quality Through Clinician Use of Health IT (IQHIT) RFA (HS-07-006):*** Designed to investigate novel methods or evaluate existing strategies for clinician use of health IT in ambulatory settings to improve outcomes through more effective CDS, medication management, or care delivery. Applicants were encouraged to demonstrate the ability of EHRs and medication management systems to effectively move evidence-based information to the point of care, including the development and utilization of machine-actionable, evidence-based clinical information to providers and participation in health information exchanges.

Applicants were encouraged to consider projects that focus on the impact of health IT on outcomes in ambulatory settings and across high-risk transitions of care, the relationship between health IT and workflow redesign, systemic barriers to health IT adoption, care for patients with multiple chronic conditions, and improved use of effective alert strategies for decision support. Twenty-four total grants were awarded in 2007. Of these grants, 21 were active in 2011 using a no-cost extension. Twenty of these projects ended in 2011, while the remaining project received a second no-cost extension and is scheduled to end in 2012.

- ***Enabling Quality Measurement (EQM) Through Health IT RFA (HS-07-002):*** Intended to develop safety and quality measures in ambulatory care settings, automate quality measurement, demonstrate the ability of electronic data systems, expand potential safety and quality measures, and demonstrate improved ability to export data for reporting performance on measures and improvement. Of the 17 total grants awarded through this RFA in 2007, only 3 were active in 2011 and all closed during the year.
- ***Improving Management of Individuals with Complex Healthcare Needs through Health IT RFA (HS-08-002), also referred to as "Management of Complex Patients" (MCP):*** Serves to demonstrate the ability of health IT to assist clinicians, practices, systems, and patients and families in improving the quality and safety of care delivery for individuals with complex health care needs in ambulatory care settings, particularly in high-risk care transitions. The long-term goal of this effort is to ensure that patients receive appropriate care and management for prevention and treatment of priority conditions. Twelve total grants were awarded in 2008. All 12 of these grants were active through 2011 using a no-cost extension.

Health IT FOAs. In September 2008, AHRQ issued three health IT FOAs. The goal of these incremental funding opportunities, which included training and development of individual research skills, was to support projects that could achieve measurable and sustained improvements in quality and safety of health care in ambulatory settings and in transitions of care through the development, implementation, and use of health IT. The applicable settings in which this funding could be applied included: ambulatory, transitions in care between ambulatory settings, or transitions in care between ambulatory and non-ambulatory settings. For the purpose of these FOAs, ambulatory care settings include: health care clinician offices, outpatient clinics, outpatient mental health centers, outpatient substance abuse centers, urgent care centers, ambulatory surgery centers, community-based, school, or occupational health centers, safety-net clinics, pharmacies, homes, independent living centers, and long-term residential care facilities.

New proposals for the R03 and R21 FOAs are still being accepted by AHRQ, while the R18 FOA closed in May 2011. The first grants of these FOAs were awarded in September 2009. The following are general overviews of each FOA.

- ***Small Research Grants to Improve Healthcare Quality through Health IT (R03) (PAR-08-268):*** Supports different types of small research studies up to 2 years, including: 1) small pilot and feasibility or self-contained health IT research projects, 2) secondary data analysis of health IT research, and 3) economic prospective or retrospective analyses of health IT implementation. A total of nine projects have been awarded under this initiative. Three projects awarded in 2009 closed in 2011. Four projects awarded in 2010 and two projects awarded in 2011 are scheduled to end in 2012.
- ***Exploratory and Developmental Grant to Improve Health Care Quality through Health***

IT (R21) (PAR-08-269): Provides funding for health IT exploratory and developmental research projects up to 2 years that support the conduct of short-term preparatory, pilot, or feasibility studies. Health IT implementation research demonstration grants are included in this category. The R21 grants are intended to be more comprehensive and broader in scope than the relatively smaller, self-contained health IT research projects supported by the health IT R03 FOA. A total of 24 R21 projects have been awarded since 2009. All five projects funded in 2009 were active throughout 2011 using a no-cost extension and scheduled to end in 2012. All projects funded in 2010 and 2011, seven and 12 respectively, were active through 2011.

- ***Utilizing Health IT to Improve Health Care Quality Grant (R18)(PAR-08-270):*** Supports demonstration research grants up to 3 years that study health IT implementation and use to improve the quality, safety, effectiveness, and efficiency of health care in ambulatory settings and transitions between care settings. A total of 21 R18 projects have been awarded since 2009; all are ongoing at the end of 2011.
- ***Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (P50) RFA (HS-10-016):*** There is one grant in this category that was funded beginning in 2011 for up to 5 years to carry out community-based participatory research on the use of communication and health IT information to improve the health status of, and health-related services provided to, older adults. P50 grants focus on applied research with the objective of developing sustainable and reproducible strategies to translate research into practice effectively and efficiently.

Other Health IT-Funded Grants. In addition to the grants described above, the Health IT Portfolio funds additional grants with a health IT

focus, which are solicited through the following FOAs:

- Career and Dissertation Awards:*** Designed to enhance the careers of health IT-focused researchers through K-awards and research dissertation grants (R36) (NOT-HS-08-014, NOT-HS-11-016). These grants support the career development of clinical and research doctorates who focus their research on one of three priority health IT research areas: 1) health IT to improve the quality and safety of medication management, 2) health IT to support patient-centered care, and 3) health IT to improve health care decisionmaking. There were 14 active career and dissertation awards in 2011; five R36, six K08, and three K01.
- Conference Support Awards:*** AHRQ continues to support conferences through its Grant Programs to support both small (PAR-09-231 Small Grant Program for Conference Support [R13]) and large (PAR-09-257 Grant Program for Large Conference Support [R13] and [U13]) conferences to help further its mission to improve the quality, safety, efficiency, and effectiveness of health care for all Americans. In 2011, there were four active R13 grants under the Health IT Portfolio. Of these, one grant ended in 2011, while the remaining three were awarded in 2011 and are ongoing.
- AHRQ Health Services Research (R01) Purpose:*** In March 2007, AHRQ issued an agency-wide FOA (PA-07-243) for ongoing extramural grants for research, demonstration, dissemination, and evaluation projects to support improvements in health outcomes, strengthen quality measurement and improvement, and identify strategies to improve access. This FOA was reissued in 2009 (PA-09-070). In 2011, there were three active R01 grants under the Health IT Portfolio, one funded in 2009 and two funded in 2011.

Centers for Education and Research on Therapeutics (CERTs) (U18, U19): AHRQ was given responsibility for administering the CERTs demonstration program authorized by Congress as part of the Food and Drug Administration Modernization Act of 1997 (Public Law 105-115). AHRQ awarded grants to support the first four centers in September 1999, and the full CERTs program was established as part of the [Healthcare Research and Quality Act of 1999](#) (Public Law 106-129). CERTs conduct research and provide education to advance the optimal use of drugs, medical devices, and biological products; increase awareness of the benefits and risks of therapeutics; and improve quality while cutting the costs of care. CERTs consist of 14 research centers and a coordinating center. In 2011, there were three active CERT programs under the Health IT Portfolio, one funded in 2007 (U18) and two funded in 2011 (U19).

Table B-1: AHRQ-Sponsored Health IT Funding Opportunity Announcements and Special Emphasis Notices

Announcement Number	Title and Hyperlink	Year Awarded	Number of Grants Active as of 2011	New Grant Proposals May be Submitted
RFA-HS-10-016	Active Aging: Supporting Individuals and Enhancing Community-based Care through Health Information Technology (HIT) (P50)	2011	1	No
RFA-HS-11-004	Centers for Education and Research on Therapeutics (CERTs) (U19)	2011	2	No
PAR-HS-08-268	Small Research Grant to Improve Health Care Quality Through Health Information Technology (IT) (R03)	2009	9	Yes ⁶
PAR-HS-08-269	Exploratory and Developmental Grant to Improve Health Care Quality Through Health Information Technology (IT) (R21)	2009	24	Yes ⁶
PAR-HS-08-270	Utilizing Health Information Technology (IT) to Improve Health Care Quality (R18)	2009	21	No
NOT-HS-08-014, NOT-HS-11-016	Special Emphasis Notice: Career Development (K01, K02, K08) and Dissertation (R36) Grants Focused on Health Information Technology (IT)	2009	14	Yes ⁶
PAR-09-231	Small Grant Program for Conference Support (R13)	2009	2	Yes ⁷
PA-07-243 and PA-09-070	AHRQ Health Services Research (R01)	2009	3	Yes ⁸
PA-09-257	AHRQ Grant Program for Large Conference Support (R13) and (U13)	2008	2	Yes ⁸
RFA-HS-08-002	Ambulatory Safety and Quality Program: Improving Management of Individuals with Complex Healthcare Needs Through Health IT (R18)	2008	12	No
RFA-HS-07-004	Centers for Education and Research on Therapeutics (CERTs) (U18)	2007	1	No
RFA-HS-07-007	Ambulatory Safety and Quality: Enabling Patient-Centered Care Through Health IT (R18)	2007	14	No
RFA-HS-07-006	Ambulatory Safety and Quality Program: Improving Quality Through Clinician Use of Health IT (R18)	2007	21	No
RFA-HS-07-002	Ambulatory Safety and Quality Program: Enabling Quality Measurement Through Health IT (R18)	2007	3	No
RFA-HS-05-013	Limited Competition for AHRQ Transforming Healthcare Quality Through Information Technology (THQIT)—Implementation Grants	2005	None	No
RFA-HS-04-010	Transforming Healthcare Quality Through Information Technology (THQIT)—Planning Grants	2004	None	No
RFA-HS-04-011	Transforming Healthcare Quality Through Information Technology (THQIT)—Implementation Grants	2004	None	No
RFA-HS-04-012	Demonstrating the Value of Health Information Technology	2004	None	No

6 Active until November 17, 2013.

7 Active until October 23, 2012.

8 Active until January 8, 2013

Appendix C – AHRQ Sponsored Health IT Contracts

Table C-1: AHRQ Sponsored Health IT Contracts Active in 2011

Number of Contracts Active as of 2011	Title
One-Time Requests for Proposals	
3	State and Regional Demonstrations in Health Information Technology
2	Clinical Decision Support Services
Master Contracts Through Which Active Health IT Portfolio Task Orders Were Issued:	
9	Accelerating Change and Transformation in Organizations and Networks (ACTION)
3	Evidence-Based Practice Care Centers
3	Medicaid/CHIP Technical Assistance Contract
3	Interagency Agreements
11	General Health IT Task Order
5	Primary Care Practice-Based Research Networks (PBRNs)
1	Program Evaluation and Analysis Task Order Contract (PEATOC)



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