



Using Health Information Technology To Determine Medication Adherence

Findings from the AHRQ
Health IT Portfolio



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Health IT

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Background

Medication Adherence Overview

Adherence to (or compliance with) a medication regimen is generally defined as the extent to which patients take medications as prescribed by their health care providers.¹ Adherence is important to obtaining or maintaining improved health of patients with chronic or severe health conditions. Research has reported a 76-percent discrepancy in adherence between medications prescribed and taken.² The medication regimen prescribed is intended to maintain the desired level of medications in the bloodstream to achieve the desired result.

Although individual studies exist in the area of adherence of a certain group of patients or to a type of medication, very little peer-reviewed literature is available on the methodology for determining medication adherence in general. Most studies develop project and study-specific approaches and methodologies in calculating adherence rates.

It is difficult to determine whether a patient is actually taking a medication as prescribed at the directed time of day without specialized monitoring devices. Patient self-reported information can provide useful information, but presents its own limitations with regard to data accuracy and reliability. The use of health information technology (health IT) applications, such as electronic health records (EHRs) by providers and personal health records (PHRs) and patient portals by patients, and the use of electronic pillboxes and medication event monitoring systems (MEMS) medication bottle caps have likely increased access to varied data sources for adherence-related information. However, less information is available on the approaches and challenges to automating the determination of medication adherence via health IT.

¹Osterberg L, Blasche T. Adherence to medication. *N Engl J Med* 2005;353: 487-97.

²Bedell SE, Jabbour S, Goldberg R, et al. Discrepancies in the use of medications: their extent and predictors in an outpatient practice. *Arch Intern Med* 2000;160: 2129-34.



AHRQ ASQ Program and Grants

The purpose of AHRQ's Ambulatory Safety and Quality (ASQ) Program is to improve the safety and quality of ambulatory health care in the United States. The ASQ Program within AHRQ's Health IT Portfolio includes four initiatives consisting of grants awarded via funding opportunity announcements (FOAs) that accentuate the role of health IT in the ambulatory care setting:

1. Enabling Quality Measurement Through Health IT (EQM)
2. Improving Quality Through Clinician Use of Health IT (IQHIT)
3. Enabling Patient-Centered Care Through Health IT (PCC)
4. Improving Management of Individuals With Complex Healthcare Needs Through Health IT (MCP)

Scope and Approach

The AHRQ National Resource Center (NRC) for Health IT conducts Open Forums via Web conference with AHRQ ASQ grantees that provide a venue for grantees to discuss topics of interest and share experiences and lessons learned. Open Forum topics are selected by AHRQ and the NRC based upon grantee input, and grantee participation during Open Forums is voluntary. Medication adherence was identified as an area of both commonality and interest across multiple grantees within the ASQ Program.

AHRQ invited 15 grantees categorized as having medication adherence as an aspect of their project to two Open Forum sessions conducted in November 2008. This determination was based on their grant application, progress reports, comments made during the AHRQ annual conference, and other communications with the NRC and/or AHRQ. Grantee projects expressed interest in discussing the adherence measures used by grantees, understanding reasons for nonadherence, data sources for calculating adherence, tools and approaches in grouping medication adherence by therapeutic class.

Medication adherence is a component of the projects discussed within this report, but often not the primary focus. Some AHRQ-funded projects are evaluating whether presenting medication adherence information to providers and/or patients via health IT solutions



impacts patient adherence to prescribed medications. During the process of conducting these studies, these experiences can contribute valuable information to the field in the area of determining medication adherence. These projects were in the beginning of the second year of their 3-year grant period at the time of the Open Forum.

This report describes some of the approaches and challenges discussed by the seven AHRQ ASQ grant projects that participated in the Medication Adherence Open Forums. This report profiles the different approaches grantees have used to calculate medication adherence and the data sources that are being used by the projects. The electronic source of data that can be tied to patient adherence is prescription fill information, obtained via the pharmacy, pharmacy benefit manager, or payer. This report also describes some of the challenges in associating prescription data and pharmacy data and discusses needed processes and standards to improve usage of this information. Finally, this report provides grantee feedback on the lack of tools and standardized instruments to support the synthesis and use of adherence information to improve patients' health.





Calculating Medication Adherence

The various approaches used by the grantees to calculate medication adherence are discussed in this section. There is currently no widely accepted method of determining medication adherence. Grantees commented on the lack of consensus and standardization in the industry today and indicated that additional research and knowledge is needed in this area.

When discussing commercially available adherence information or standardized adherence measures, Michael Fischer, M.D., M.S., noted, “Even if adherence information was available, I think my concern is that we would want to have more control over being able to understand the measure and figuring out if we are getting the measure right. We are still at the stage where we do not know for sure if we are getting the measures correct. We want to be able to try different ways of doing this and try to figure out what the standard should be.”

Days Covered and Fill Adherence

Carrow GM, Fischer MA, Lapane KL, and Lobach DF are principal investigators for projects that link electronic prescription information to prescription fill information. Some of these projects use this information to present providers with information on adherence to medications during a patient encounter. Prescribing date and duration (usually via refill amounts) are available within the provider’s electronic prescribing (e-prescribing), EHR, or health information exchange (HIE) system. Pharmacy information includes fill date and days supplied information.

- Currently, all medications for controlled substances are either handwritten or faxed. Carrow GM and colleagues are analyzing implementation of a system for e-prescribing of controlled substances. This includes, as an adjunct to the project’s main goals, determining the feasibility and value of comparing controlled medications prescribed within the system with pharmacy data that is already collected as part of a State prescription drug monitoring program. It is expected that such a comparison can determine whether patients are actually picking up their controlled substance prescriptions, as an indirect and partial measure of adherence. Patient adherence can be a strong predictor of effectiveness of care and can provide early indications of any



abuse or diversion, which are key factors for consideration in the prescribing of controlled substances. This project will examine interruption in therapy, changes in patterns in adherence, and pre- and postimplementation of this research on and demonstration of e-prescribing of controlled substances.

- Fischer MA and colleagues are working to understand the predictors of adherence and nonadherence at the patient and provider level. The project team has partnered with an e-prescribing vendor to obtain system use data by linking patient information to pharmacy claims information for patients participating in two private insurance plans within Massachusetts. This project does not track information to the individual patient, as the data is encrypted. The project is designed to calculate adherence to chronic medications, as measured by the percentage of days covered within the first 100 days after the medication is initiated. This is found by computing both the date the prescription was filled and the days supplied field in pharmacy claims. The second measure under consideration is time until a medication is discontinued, where discontinuation is defined as being a period of 60 days after the completion of a prescription for which no refill was obtained. These measures capture two aspects of adherence: persistence (how long medication is used), and intensity of use. This should predict whether patients follow directions for their first prescription and continue adhering afterwards.
- The e-prescribing system implemented by Lapane KL and colleagues will include a display of the expected fill pattern versus actual fill pattern for randomized patients participating in the project. This will be displayed within the e-prescribing system, which is using medication history information available via Surescripts™ to display the actual fill pattern.
- Lobach DF and colleagues are using the number of days prescribed as indicated in Medicaid claims information to examine medication coverage. The project uses pharmacy claims information to graphically display when patients have been filling their medications as well as calculate the days covered for the particular class of medications. The focus of this project is to improve medication adherence by making information more available in a primary care setting at the point of care.



Medication Possession Ratio Within an E-Prescribing System

The medication possession ratio (MPR) as a measure of adherence has gained adoption in the industry. MPR is a formula used to determine compliance that is measured from the first to the last prescription. The denominator is the duration from the start period to the completion of the last prescription, and the numerator is the number of days supplied over that period from first to last prescription.³

- Lapane KL and colleagues are working with their e-prescribing vendor to develop a product enhancement to calculate MPR, as the majority of e-prescribing solutions currently do not provide this information.

Adherence by Class

Adherence to specific prescribed medications may not provide the most useful information, particularly for patients with chronic conditions. Some projects are calculating adherence to medications by therapeutic class, which involves additional analysis to group medications. Viewing adherence by class can provide a more comprehensive view of a patient's adherence, as the use of generics, therapeutic equivalents, and different medications within a class often occurs for patients with chronic conditions. A standardized industry coding system in use for medication classes does not currently exist, requiring the AHRQ projects to group medications into classes as part of their projects.

- Adams WG is grouping controller versus reliever medications for pediatric patients with asthma. He noted that the project has been able to group asthma medications into the controller versus reliever group fairly well without much overlap.
- The prescription drug monitoring system at the Massachusetts Department of Public Health that Carrow GM is working with monitors Schedule 2 controlled substances, supporting one of the goals of this project, which is to determine the feasibility and value of linking e-prescribing system and prescription drug monitoring system data to measure adherence and drug diversion.

³Blanford L, Dans PE, Ober JD, Wheelock C. Analyzing variations in medication compliance related to individual drug, drug class, and prescribing physician. *J Managed Care Pharm* 1999;47-51.



- Fischer MA is considering grouping of medications and adherence by class as a possible next step. In addition to therapeutic classes, he indicated that there are also differences in acute versus chronic medications. Another consideration his project may consider is looking at medications associated with symptomatic conditions as well as more granular therapeutic classes.
- Lobach DF and colleagues are first grouping medications by class for a patient, and then performing a calculation for a certain period for the individual drug and showing the adherence level. This project is finding that sometimes someone may change medications, but they are still taking the same class of medication so the project is grouping medications by class. The decision support within the HIE system is using what is known about the medication the patient appears to be taking based upon pharmacy claims and the medical condition within the HIE repository. The system is then providing recommendations to the provider that highlight a missing class of medication based on the system's decision support analysis.

Patient Self-Reported Adherence

Adams WG, Berner ES, Jack BW, and Lapane KL are four grantees who are capturing patient self-reported information on adherence using various health IT tools or patient interviews. The Morisky Scale, a standard medication adherence scale in the literature, is being used by projects led by both Berner ES and Lapane KL.

- Adams WG and colleagues have developed an automated telephony system for previsit interviews before primary care visits in pediatrics. The project is trying to assess via the phone whether asthma medications are measured and administered correctly.
- Berner ES and colleagues are focusing on tracking diagnoses by following up with patients to check their outcomes after the initial visit in the ambulatory care setting. Medication adherence plays a role in that the project plans on giving feedback to providers, primarily on whether patients have improved, have adhered to their medications, and encountered any side effects. The project is not primarily targeting medication adherence, but looks at a provider's evaluation of whether a reconsideration



of diagnoses is needed. The method for collecting adherence information is first via direct patient interviews, but this information will eventually be automated via an Interactive Voice Response (IVR) system. The project is asking patients three specific questions: (1) Did you fill the prescription?, (2) Did you take it as prescribed?, and (3) Did you experience any side effects?

- Jack BW and colleagues have developed a Web-based platform that presents an interactive “character” to the patient to collect information about patient adherence. Prescription information is captured within the system from the hospital at time of discharge; patient adherence to those medications will be captured by the system. This project will explore whether patients (1) think they need to take their medicines; (2) did not fill the prescription because of costs; (3) did not pick up medications from the pharmacy; (4) did not get the prescription before they left the hospital, and (5) stopped taking the medication because of side effects. In addition, the project will present some strategies to help patients solve the problems they identify as to why they are or are not taking the medicine.

Determining Reasons for Nonadherence

Grantees reported that gaining a better understanding of adherence issues for patients requires knowledge of whether the nonadherence issues are intentional. The projects examining reasons for nonadherence have developed mechanisms for additional patient input in these areas.

Reasons for nonadherence discovered by the grantees include: cost, side effects, incorrect self-administration, “just-in-case” medications, system errors, and nonintentional issues such as forgetting to take the medication or not picking up the medication from the pharmacy.

- Jack BW and colleagues have developed a system for reporting that breaks adherence issues down to: failure to take a medication, incorrect self-administration, and system errors leading to adherence problems. Percentages are calculated for each of these three domains relative to adherence. The project can also report on the total number



of patients who need an intervention to correct them or get them back on course, and, of those, which patients were discharged from the hospital at a certain point in time.

- Lapane KL reported that the project leads struggled with the idea that adherence issues in older populations were not intentional nonadherence issues. The project team developed questions that would capture from an elderly patient, how often in the last month the patient intentionally did not take his/her medication versus forgetting to take his/her medication. The project is also trying to understand from this survey, what people do to help them take their medications. Initially, the assumption was that patients were forgetting to take their medications, but the team discovered that some patients were intentionally skipping doses of their medications.
- Lobach DF and colleagues are planning a contextual evaluation for the project where they propose actually going into the setting where their project intervention occurred and conducting interviews. These interviews will help inform the project on what people are learning and provide feedback about why people are not adhering to their medications.

Data Sources

In addition to the various approaches to calculating medication adherence and evaluating impacts of adherence-related information, the various data sources for the information present their own set of considerations and challenges. The studies in progress by the AHRQ ASQ grantees are using a variety of data sources and can provide insight into the appropriateness of these sources as their projects near completion:

- Pharmacy claims information from insurers (Fischer MA, Lobach DF).
- Pharmacy dispensing information from public health records (Carrow GM).
- Pharmacy dispensed information from software vendor or via Surescripts (Carrow GM, Lapane KL).
- Pharmacist qualitative interviews (Carrow GM).
- Prescriber and provider interviews (Carrow GM, Lobach DF).



- Prescriber surveys (Carrow GM).
- Patient or parent interviews (Adams, Berner, Jack BW, Lapane KL, Lobach DF).
- Patient or parent adherence input via telephony (Adams WG, Berner ES).
- Patient adherence input via online applications (Jack BW).
- Patient chart audits (Lobach DF).





Associating Prescription Data With Pharmacy/Payer Data

The primary method used to determine medication adherence using electronic data sources is via linking electronic prescription information from the e-prescribing system with pharmacy fill information. The two most common sources of fill information are pharmacy claims data provided by the insurer (or pharmacy benefit manager) and via the medication history transaction available via the Surescripts™ e-prescribing network.

Insurer Pharmacy Data

Fischer MA and Lobach DF are linking electronic prescriptions and claims information and discussed the following challenges with the data linked via this process:

- **Low Cost Generics:** Many patients are paying cash/out-of-pocket for their prescriptions and therefore data is not captured in the insurer claim for generic prescriptions available at a low cost. For example, Wal-Mart and Target pharmacies offer a \$4 prescription program. If patients fill their prescriptions via this program, a claim is never filed with the insurer and the insurer will never receive dispensing information for the related prescriptions to link with the prescription data.
- **Access to Medicare Part D Data:** Lobach DF notes that although the Medicaid population his project works with may be less affected (prescriptions are less than \$4 via Medicaid), the availability of the \$4 generic prescriptions is still a concern. The Part D Medicare program has been initiated since the project was defined, which may cause a gap in available data as the project has a number of patients who are dually eligible and will be using the Part D claims for their pharmacy needs. It has been a challenge to obtain Part D pharmacy data via Medicare itself or pharmacy benefit managers (PBMs) that service the low-income individuals in the region.
- **Timeliness of Data:** Adherence information, i.e., effectiveness of treatment, can be valuable to the provider and useful during the patient care process. In the management of chronic or severe conditions, patient adherence to medication regimens can be critical to improving the patient's health. There can be a delay in the availability of



dispensing information received from the insurer. For example, Lobach DF indicated that the project waits 6 months to perform analysis on claims data to ensure they are complete.

- **Failed Matches:** Errors in the matching process may exaggerate the nonadherence calculation. Fischer MA described that knowing the pharmacy name can be helpful in debugging failed matches. Prescriptions that are sent and resent, because patients are going to a different pharmacy, or the prescription is printed and the patient is going to a different pharmacy for the refill, are scenarios that present challenges in trying to debug failed matches.
- **Patient-Specific Instructions:** Lobach DF and Fischer MA both described challenges in medication adherence information for prescriptions that have special patient instructions. Prescriptions written for double dosage (where the patient splits the pill and takes the medication for double the duration) are not easily distinguishable in electronic claims information and adherence calculations. “Just-in-case” medications, where the prescription is sent and the patient may not fill or pick up the medication, are also not easily distinguishable.

Surescripts™ Medication History Data

The Surescripts™ e-prescribing network provides access to medication history information from PBMs and many retail pharmacies. Medications are available in this data set if a prescription is filled by the dispenser, regardless of whether a claim was submitted to the patient’s insurer. If a prescription is filled and not picked up by the patient and then is in turn restocked, the medication history information for a patient is not updated. There is discussion in the industry regarding use of a specification for “Fill Status,” but is not in use by retail pharmacies and e-prescribing systems at this time.



Medication Terminology Standards

Pharmacy claim information includes the National Drug Code (NDC) for the prescription dispensed. The e-prescribing system often codes medications using proprietary vendor or drug knowledgebase vendor (e.g., First DataBank, Multum) codes. E-prescribing systems are starting to incorporate RxNorm coding, but its use is not yet widespread or universal. NDC codes are not available for a drug until it is dispensed, as there are multiple NDC codes for the same medication. Analysis of insurer and prescribing data requires data mapping between medication codes and NDC codes, which Lobach DF and Fischer MA acknowledge is quite cumbersome.

Lobach DF also indicated that drug classes for medications are not standardized and are usually dependent upon the drug knowledgebase vendor. When looking at prescribing information from different systems, different codes or mapping for drug classes are used. The project examined First DataBank class information to determine whether the medications identified in the various classes were appropriate as well as the knowledge rules the project was going to use to assess whether a patient is on the correct medication.





Needed Tools, Instruments, and Surveys

There is a lack of standardized tools and instruments to collect adherence-related information from patients and providers. Jack BW noted, “If there was a standard instrument that existed, it would be nice to report adherence in a standard way if there was a standard or accepted tool that is used. It would be nice if our project used a similar instrument so it means something around the country.”

Adams WG, Berner ES, Jack BW, and Lapane KL all expressed the challenges in locating and developing standard tools, surveys, and instruments to support the adherence aspects of their projects. As noted earlier, both Berner ES and Lapane KL are using the Morisky scale. Many of the Open Forum participants indicated that they were still searching for instruments. Others noted that the applicability of instruments available via the Internet or literature was limited, as they were often specific to the goals or objectives for other studies for specific patient populations and conditions. Adams WG noted an instrument intended for paper-based or in-person administration is challenging to modify to an electronic or interactive system.

The grantees cited the following gaps in the industry today to support research on medication adherence:

- Prescriber surveys on adoption of electronic prescribing technology.
- Prescriber surveys to measure compliance.
- Surveys and tools for capturing patient-reported data.
- Lack of standardized surveys or instruments.
- Lack of broad/generalized surveys (mostly disease/drug specific).
- Lack of tools capturing reasons for nonadherence.
- Lack of low-reading level or language-specific tools.
- Standard measures and data sources for medication adherence.
- Uniform definition of intentional versus nonintentional nonadherence.





Conclusion

These AHRQ-funded ASQ grants are entering the middle of their second year of a 3-year grant period. The projects are continuing to provide valuable, informative experiences and lessons and contributing to the needed base of knowledge in the area of medication management, medication adherence, and electronic prescribing.

The projects described in this report have uncovered a number of important lessons about the challenges and opportunities associated with obtaining and using medication adherence information in real-world clinical settings. It is the hope of AHRQ and its NRC for Health IT that others who wish to use medication adherence information in their clinical and care processes can learn from the experiences of these projects.





Appendix: AHRQ ASQ Grantees Informing the Area of Medication Adherence

The 15 AHRQ ASQ projects that include medication adherence as a component of their project are listed below.

PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
<p>William Adams* Conversational IT for Better, Safer Pediatric Primary Care</p>	<p>This project provides an automated telephony system as part of prevention services delivered in a pediatric practice. The system will gather personal health data and counsel parents before scheduled visits, integrate that data with the physician’s EHR, and offer personalized followup assessment and counseling after visits.</p>	<p>The content of the previsit health assessment call includes medication management questions using data extracted from the child’s EHR via HL7. Medication management questions include medication usage and dosing of liquid medications (whether the child is taking more or less of a medication than recommended), medication reconciliation (reviewing the medication list and confirming its accuracy), and asthma medication use.</p>
<p>Eta Berner* Closing the Feedback Loop to Improve Diagnostic Quality</p>	<p>The project is designed to measure the quality of diagnosis in an outpatient setting, the extent of outpatient medication safety and quality and the impact on physicians and patients of active followup after being treated in an ambulatory setting or emergency room.</p>	<p>The plan is to design a system to proactively obtain information about the patient’s treatment outcomes (including medication adherence and adverse events related to prescribed medications), to provide that information to the clinician, and to track the changes in diagnosis and treatment as a result of the feedback.</p> <p>The Morisky scale will be used to ascertain patient medication adherence during IVR followup and include the variations of the following questions:</p> <ul style="list-style-type: none"> • Do you ever forget to take your medicine? • Are you careless at times about taking your medicine? • When you feel better, do you stop taking your medicine? • Sometimes if you feel worse when you take your medicine, do you stop taking it?



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
Alfred Bove Using a Telemedicine System to Promote Patient Care Among Underserved Individuals	<p>This project builds on a telemedicine system through which patients provide self-reported blood pressure results by incorporating hypertension treatment guidelines, quality measures, automated reminders and feedback for both patients and providers. The patients provide weekly reports of their weight, blood pressure, and comments about their current health status, including medications.</p>	<p>Through the PHR, the patient has the ability to self-monitor and review health trends, medications, and guidelines as well as access educational information. A secondary endpoint of the project will be the number of patients at guidelines for antihypertensive medication therapy.</p>
Edith Burns Enhancing Self-Management of Type-II Diabetes with an Automated Reminder and Feedback System	<p>This project is testing whether an automated self-management monitor (ASMM) in the patient's home that prompts patients to perform self-monitoring of blood glucose (SMBG), take medication, and provides patient education on how lifestyle choices affect blood sugar, has an effect on diabetics' glycemic control and self-management behaviors.</p>	<p>The ASMM will be programmed to provide audio reminders (repeated until receiving a response by the patient) to perform SMBG and take diabetic medications according to the PCP's recommended schedule.</p>
Grant Carrow* Enabling Electronic Prescribing and Enhanced Management of Controlled Medications	<p>This project will encourage the adoption and expansion of e-prescribing to cover federally controlled substances (e.g., narcotics, stimulants, sedatives). It will improve medication management by ambulatory care clinicians at the point-of-care and will also increase access to needed medications, as well as reduce risks of prescription fraud and other drug diversion.</p>	<p>This project will include testing the system's capacity to measure patients' adherence to their medication regimens, particularly those patients with chronic medical conditions who are prescribed federally controlled substances.</p>



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
Elizabeth Chrischilles Personal Health Records and Elder Medication Use Quality	The project is evaluating the ability of a PHR to support patients' medication adherence, medication use quality, and medication management behaviors. The team is testing the existing PHR by measuring elderly patients' interaction with the technology and their resulting self-activation with respect to medication management and will adapt it to the needs of patient population.	The measures of adherence will be both self-reported and from pharmacists' dispensing records. The project will use 12-month prescription refill histories from subjects' pharmacies and measure the accuracy of the patient's medication list by comparing it to the active medication list constructed from the prescription dispensing records. The project is also measuring patient opinions and self-efficacy with respect to medication therapy management.
Michael Fischer* Impact of Office- Based E-Prescribing on Prescribing Processes and Outcomes	The project will measure physician use of two safety-related e-Rx functions (safety alerts and, dispensed drug history) and the effect of e-Rx on processes of prescribing for physicians in order to assess characteristics of successful and productive adoption	This project will study several measures of patient adherence for prescribed medications. The first dependent variable will be adherence to chronic medications, as measured by percentage of days covered within the 100 days after the medication is initiated. This will be computed using both the date the prescription was filled and the 'days supplied' field in pharmacy claims. The second measure that we will consider is time until a medication is discontinued, where discontinuation is defined as being a period of 60 days after the completion of a prescription for which no refill was obtained. These measures capture two aspects of adherence: persistence (how long medication is used) and intensity of use.



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
William Gardner Pharmaceutical Safety Tracking (PhaST): Managing Medications for Patient Safety	<p>The project's goal is to improve the monitoring of outpatients taking risky medications by using innovative information technology and physician extender services that do not exclusively depend on a patient's visits to a clinician. The project uses interactive voice response telephony and computer-assisted triage interviewing to detect problems as well as an electronic health record to assist clinicians in decision making.</p>	<p>This project will now be using patient self-report of medication use. The project was originally planning to perform electronic monitoring via use of MEMS caps. Institutional Review Board (IRB) feedback regarding use of MEMS caps required project modifications that exceeded the abilities of the project/grant.</p>
Brian Jack* Virtual Patient Advocate to Reduce Ambulatory Adverse Drug Events	<p>This project expands and tests the use of a Virtual Patient Advocate (VPA) to interact with patients during the transition from the hospital to the ambulatory setting on patient activation and satisfaction, medication adherence, adverse drug events (ADEs), and self-management. The VPA will be accessible to patients via a Personal Digital Assistant (PDA) with an audio touch screen to provide patient education on their hospital stay and followup care plan.</p>	<p>The patient's daily PDA encounter includes a detailed discussion of medication management information from their hospital discharge plan, including side effects, warnings, and special instructions. There will be another review with the VPA at an office kiosk before the patient's first ambulatory appointment, nurse followup, and a report for the Primary Care Physician (PCP) with information on medication adherence, side effects, and symptoms, from the data collected in both the hand-held and kiosk VPAs over the preceding weeks.</p>



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
<p>Kate Lapane* Optimizing Medication History Value in Clinical Encounters with Elderly Patients</p>	<p>The project will develop geriatric-specific algorithms to identify potential issues with medication management (e.g., polypharmacy, potentially inappropriate medication use, duplicative therapy, non-adherence) using community-pharmacy generated medication history. In addition, it will test the impact of these interventions on clinician behavior, and develop a "tool-kit" of resources that include developed intervention products for use by nonphysician providers in other ambulatory settings.</p>	<p>The project aims to prove that the quality of medication management in clinician office encounters will be improved in physician practices receiving the intervention relative to practices without the intervention. The project intervention will:</p> <ul style="list-style-type: none"> • Aid in the evaluation and prioritization of medication management issues (e.g., polypharmacy, nonadherence issues, potentially inappropriate medications) at the point of prescribing. • Facilitate the incorporation of information regarding medication issues into the clinical encounter. • Foster clinician-geriatric patient/caregiver communication regarding potential medication management issues. • Promote the optimal integration of medication-history data at the point of prescribing. • Assist clinicians in evaluating and monitoring complex medication regimens to assist in identifying, resolving, and preventing medication-related problems. • Facilitate informed, shared decisionmaking and monitoring for medication-related problems.



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
<p>Kate Lapane* Tailored DVD to Improve Medication Management for Low Literate Elderly Patients</p>	<p>This project gathers information from a population-based sample of geriatric patients' medication history to create tailored print and video materials for low-literate patients that illustrate principles of medication adherence and to provide guidance on medication use.</p>	<p>The medication history data will be analyzed to identify inappropriate usage, chronic disease maintenance, therapeutic classes relevant to this patient population, interactions, and duplicative therapy. The survey questions will include questions on number of medications taken, fidelity to prescription, dosage errors/nonadherence, ensuring that the doctor knows all medications taken, and understanding doctor instructions.</p>
<p>David Lobach* Improving Quality Through Decision Support for Evidence-Based Pharmacotherapy</p>	<p>The project seeks to improve care quality and safety in an ambulatory care setting through clinical decision support for evidence-based pharmacotherapy delivered as point-of-care reports to clinic-based practitioners and as population health-based alerts to care managers.</p>	<p>The HIE network will be enhanced to deliver reports comprised of patient-specific medication adherence data (percentage of days covered by each medication) and to deliver notifications about patient-specific medication adherence asynchronously to care managers.</p> <p>Proposed intervention will focus solely on medication management and will span across multiple priority conditions to provide a more comprehensive view of a patient's pharmacotherapy.</p>



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
Jonathan Nebeker VA Integrated Medication Manager	This project will compare the new Integrated Medication Manager to the current version of the Veterans Administration’s Computerized Patient Record System (CPRS). The project includes a plan to evaluate a new intervention in terms of its effect on blood pressure, impact on team interactions and communication, and effect on adverse drug events (ADEs) as well as evaluate it as a tool for continuous medication reconciliation.	This project will use a new technology, called the Integrated Medication Manager, to facilitate improved decisionmaking by helping clinicians to consider more relevant data and to better plan patient care. The system will explicitly link patient problems, therapies, and goals and evaluate the social and cognitive aspects of medication management. The new technology graphs estimates of adherence, the prescribed drug dose, and the value of the clinical goal and over time.
Dean Schillinger Harnessing Health IT for Self-Management Support and Medication Activation in a Medicaid Health Plan	This project enhances automated telephone self-management support to provide surveillance and education and prioritize further telephone care management to diabetic patients via questions on patient behaviors related to diabetes management and preventive care, and examines the effects on patient experiences with care and prevalence of adverse events.	Each week, patients receive a rotating set of diabetes self-care queries about medication adherence, self-monitoring of blood glucose, diet, exercise, and so on, as well as psychosocial and prevention questions. Patients respond via touch-tone commands, and may receive education messages based on their answers. Some patients will also receive additional outreach calls from their care manager to further activate patients with respect to medication adherence and/or intensification.



PI, Project Name (* Indicates Open Forum Participant)	Project Description	Description of Medication Adherence Project Component
Paul Tang Patient-Centered Online Disease Management Using a Personal Health Record System	This project upgrades and tests an existing chronic disease management system (composed of a PHR and secure messaging) to activate diabetic patients via a home medical device (glucometer) that wirelessly transmits clinical data into an EMR with individualized and partially automated "nuggets" of patient information, and evaluates if this improves clinical outcomes.	The decision model evaluating the current state of a patient includes clinical parameters, demographic characteristics, disease-related knowledge, attitudes, and behaviors, including medication adherence, diet, physical activity, and self-monitoring. The online disease management system allows patients to enter self-monitored data, also including medication adherence information. One of the secondary hypotheses is testing the intervention's effects on patients' medication adherence levels.





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