

*Final ACTION Contract Report*

# Improving Asthma Care With Health Information Technology



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*Final Report*

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# Improving Asthma Care With Health Information Technology

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## Preface

This project was funded as an Accelerating Change and Transformation in Organizations and Networks (ACTION) task order contract. ACTION is a 5-year implementation model of field-based research that fosters public–private collaboration in rapid-cycle, applied studies. ACTION promotes innovation in health care delivery by accelerating the development, implementation, diffusion, and uptake of demand-driven and evidence-based products, tools, strategies, and findings. ACTION also develops and diffuses scientific evidence about what does and does not work to improve health care delivery systems. It provides an impressive cadre of delivery-affiliated researchers and sites with a means of testing the application and uptake of research knowledge. With a goal of turning research into practice, ACTION links many of the Nation's largest health care systems with its top health services researchers. For more information about this initiative, go to <http://www.ahrq.gov/research/action.htm>.

This project was one of seven task order contracts awarded under the “Improving Quality through Health IT: Testing the Feasibility and Assessing the Impact of Using Existing Health IT Infrastructure for Better Care Delivery” request for task order (RFTO). The goal of this RFTO was to fund projects that used implemented health IT system functionality to improve care delivery. Of particular interest were projects that demonstrated how health IT can be used to improve decision support, automate quality measurement, improve high-risk transitions across care settings, reduce error or harm, and support system and workflow design, new care models, team-based care, or patient-centered care.

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# I. Introduction to the Final Report

## Goals and Objectives for the Original Contract

This is the final report for the contract entitled “Improving Asthma Care in an Integrated Safety Net Through a Commercially Available Electronic Medical Record,” also known as the Health Information Technology (IT) Asthma Project. The original motivation for the Health IT Asthma Project was a request for proposal (RFP) issued by the Agency for Healthcare Research and Quality (AHRQ), seeking ways to demonstrate the use of health IT for quality improvement purposes. In its response to the RFP, the Health IT Asthma team proposed to create a link between two existing pieces of health IT to leverage the power of both.

One piece of technology was a small Java-based applet that provided decision support for assessing asthma severity and selecting treatment medications consistent with guideline recommendations for the patient’s age and level of severity. The guidelines had been released by the National Asthma Education and Prevention Program (NAEPP) in 2002.<sup>1</sup> The technology had been made available by the Minnesota Department of Health in 2005 and could be executed on a desktop computer or server. Upon completing a session with the technology, the program generated a patient-specific, single-page asthma action plan.

The other piece of technology was a large, commercial, enterprise electronic health record (EHR) system, created and maintained by the vendor, EpicSystems, Inc. Despite its size and complexity (or perhaps because of it), it had proven to be an insurmountable challenge to use Epic to replicate the ability of the comparatively tiny applet to automatically generate a patient-specific asthma action plan with the desired visual features.

The original proposal in response to the AHRQ RFP was to create a link between Epic and the applet, so that while treating a patient using the Epic interface, a user could invoke the applet and generate the asthma action plan. The goal was to create a “light” interface with the following properties:

- A user already logged into Epic would not have to log in again.
- The patient would already be identified (e.g., the user who already was viewing the patient’s chart in Epic would not have to look up the same patient when the applet was invoked).
- The user would not have to reenter data about the patient that already existed in Epic.
- The asthma action plan generated by the applet would become part of the patient’s legal medical record.
- Data gathered through the applet would subsequently be available for analysis.

At the time the health IT Asthma Project team submitted its proposal (June 2007), it was known that new guidelines for diagnosing and treating asthma were expected to be released in August 2007.<sup>2</sup> The new (2007) guidelines were known to differ from the older (2002) guidelines in one significant way: In addition to the concept of asthma *severity*, conceived as an underlying

and seldom-changing property of the patient, the new guidelines introduced the concept of asthma *control*, conceived as a patient's time- and situation-dependent responsiveness. Since it did not make sense to create an interface between an enterprise EHR system and an applet that would become out of date by the time the project began, the team also proposed to update the existing applet to make it consistent with the new guidelines.

The technological objectives of the original proposal, in the order in which they were to be completed, were as follows:

1. Update the existing asthma applet to make it consistent with the asthma guidelines by the National Asthma Education and Prevention Program (NAEPP), as represented in the document titled "*NAEPP Third Expert Panel Report (EPR-3), Guidelines for the Diagnosis and Treatment of Asthma.*"
2. Create a mechanism that would enable clinicians to invoke the updated applet from Epic, the commercially available EHR system operating at the demonstration site (Hennepin County Medical Center).
3. Merge together data generated from Epic and data generated from the applet to create an HMC Asthma Population Registry that would serve quality improvement and research needs.

The quality improvement aspects of the proposed project were twofold:

1. By enabling users to invoke the applet at the point of care, guideline-based recommendations for asthma care would become immediately available.
2. The data generated by the applet, when merged with data generated by Epic, could be used to create a registry for the organization's population of asthma patients, thus fostering population management for asthma.

Work under the contract commenced on October 1, 2007.

## **Goals and Objectives for the First Contract Modification**

By February 2008, it had become evident that it would not be possible to "update" the 2005 applet and that a completely new piece of software was required. The process of creating the new software introduced new challenges, primarily associated with interpreting the language employed in the EPR-3 into the algorithmic specificity required by a software application. These challenges, in turn, revealed a gap between what working, front-line clinicians needed from clinical practice guidelines, and what guideline development groups were accustomed to producing. To help the sponsoring agency enrich its portfolio of issues dealing with guideline development and dissemination, the agency modified the original contract so that an additional requirement was thorough documentation of the issues encountered when attempting to operationalize the asthma guidelines.

## Goals and Objectives for the Second Contract Modification

As the Health IT Asthma Project team was developing and beginning to execute its dissemination plan, and as it drew closer to placing the new applet into production at the demonstration site, both the sponsoring agency and the project team became more concerned about how the newly developed software would be supported once the contract terminated, particularly if the dissemination methods succeeded in spreading the application beyond the original demonstration site. Issues fell into the following categories:

- What can be done to make it easier for future sites to implement the application locally?
- What could be done to make it easier to keep the underlying medication content of the application up to date?
- What entity would be responsible for ensuring that the application continued to reflect best practices for asthma care, as knowledge about best practices changed over time?
- If the entity responsible for matching best practices to the application did not have technology as its core activity, what could be done to assist that entity in making changes to the technology to achieve its goals?
- What fiscal, administrative, and legal mechanisms were available to support dissemination of the application beyond its original demonstration site?

The contract was modified a second time with the additional requirement that the Health IT Asthma Project team develop a set of hypothetical mechanisms that addressed the technical, fiscal, administrative and legal aspects of widespread dissemination and ongoing maintenance, that would be sustainable beyond the termination of the original contract.

## Organization of the Final Report

This final report is organized by four major topics. Although many subtopics fall within more than one main topic, for ease of presentation, we include them only within one. The four major topics and their descriptions are as follows:

- I. **Background Materials.** This topic describes the context in which the project was initiated.
- II. **Original Technology Development.** This topic includes the process of converting the guidelines expressed in the EPR-3 into executable code, the components of the code, and the interface between the applet and Epic. Issues related to maintaining the code so that it responds to user expectations, and so that its underlying content remains current with changing knowledge in the world, are treated under Topic IV, *Dissemination and Long-Term Sustainability*.
- III. **Technology Implementation at the Demonstration Site.** This topic covers implementing the application at Hennepin County Medical Center (HCMC), a quasi-public safety net located in Minneapolis, MN. It also includes the evaluation of clinician acceptance of the

application, using as evidence the rates with which at-risk patients had completed asthma action plans generated by the application.

IV. **Dissemination, Long-Term Sustainability, and Future (Dynamic) Technology**

**Development.** This topic addresses the process of communicating information about the application beyond the original demonstration site, responding to interest in implementing it elsewhere, and the need for mechanisms that will allow the original application to change in response to changing user requirements.

## II. Original Technology Development

The Health IT Asthma Project took place at Hennepin County Medical Center (HCMC), a quasi-public safety net located in Minneapolis Minnesota. At the time the project commenced (October 2007), installation of Epic was approximately 95 percent complete. Shortly after the project commenced, the team submitted an Existing Infrastructure Report to AHRQ, in which it noted HCMC capacities with respect to technical sophistication and data management. At the time this report was submitted, the team was unaware of its own limitations with respect to software development, as well as the challenges associated with converting guidelines expressed in narrative documents into executable code. By January 2008, 4 months after project inception, it had become clear that the task which had originally been conceived as the most trivial (“updating” the MDH Interactive Asthma Action Plan to be consistent with the guidelines released in 2007) was extremely challenging.

Some of the challenges had to do with representing the guidelines—which had been expressed in a 440-page narrative document—in the form of executable code. The team eventually summarized these challenges in a formal report submitted to AHRQ. The Agency subsequently shared this report with colleagues at the National Heart Lung and Blood Institute (NHLBI), which supported the National Asthma Education and Prevention Program in the development of the guidelines. The report clearly identified ways in which guidelines released in narrative form proved to be very difficult for working clinicians to access and use.

Another set of challenges dealt with technology development itself. The software development vendor originally identified proved incapable of delivering a completed product, and in August 2008, the team released an RFP in search of a new vendor.

The remaining artifacts associated with this segment of the report concern the functioning of the decision support tool itself, named the Electronic Asthma Action Plan (eAAP). The most significant cognitive component of the tool is determining asthma control and adjusting medications given the level of control and the level of current therapeutic aggressiveness. The team used a dynamic representation of application functioning to communicate user requirements to the software developers.

The Health IT Asthma Project team represented the content of the decision support algorithms in Excel spreadsheets. These spreadsheets can be interpreted as necessary clinical knowledge content for treating patients for asthma. The most substantial spreadsheet is the one that contains treatment plans, medication types, pharmaceutical brands, strengths, and instructions for use, for all the ways that guidelines regarding daily controller medications can be operationalized. This spreadsheet contains nearly 35,000 rows, a dramatic illustration of the vastness of the necessary knowledge content required to deliver guideline-based care.

The guidelines explicitly mention 20 to 22 treatment plans for each age group, where each treatment plan is composed of one or more daily controller medications. Ten types of daily controller medications are mentioned, one of which (inhaled corticosteroids) can be delivered in

a low, medium, or high dose. These 20 to 22 explicitly mentioned plans comprise approximately 1 percent of the total number of logically possible combinations of medication types. A significant challenge faced by the Health IT Asthma Team was providing support for clinicians who were attempting to infer a patient's current level of therapeutic aggressiveness (expressed as a "step" in the guidelines) from the medications they were currently taking. Because the medications they currently were taking might be some combination other than what the guidelines explicitly recommended, the project team was required to make inferences about the 99 percent of possible combinations that the guideline developers did not mention, in addition to recommending a new treatment step, based on the clinicians' assessment of the patient's level of asthma control.

When the user completes the application (a process that takes less than 3 minutes for an experienced user), several documents are created. For the patient, the key document is a one-page, patient-specific asthma action plan, to help the patient manage his or her condition at home. The Health IT Asthma Project team designed the asthma action plan so that it met all of The Joint Commission requirements for pediatric discharges for asthma. Some of these requirements are not mentioned in the guidelines. A representative from the Minnesota Department of Health who had developed the original application (the IAAP) objected to the inclusion of Joint Commission requirements in the asthma action plan because the guidelines didn't mention them.

This section of the report also addresses the development of the tools that enable a user to invoke the eAAP from a session in Epic. Developing the model for this invocation mechanism was not a trivial task. The team had to conceive of an invocation mechanism that would be intuitively meaningful and natural to the end user, but one which also lent itself to operationalization without requiring extensive programming knowledge or time. Once conceived, it needed to be operationalized, and then tested. Testing was not just a matter of making sure that the eAAP would open when the user clicked on an intuitively placed link, it also was a matter of making sure that the patient's data were transferred reliably from the Epic session to the eAAP.

Preparing the mechanism for its final end-to-end test with users was one of the most challenging tasks the team faced, because the preparation required involvement from approximately eight different individuals, each playing different roles, not one of whom understood every piece of the mechanism from beginning to end. Interestingly, when the end-to-end test took place with the clinical users and succeeded, the users did not express the slightest surprise. The Health IT Asthma Project team considered the users' nonchalance to be an indication of a successful test, in that everything that the users expected to happen did happen, without the users having to confront any of the underlying challenges associated with achieving the task.

Six months later, when the first batch of data were undergoing thorough analysis, the Health IT Asthma Project team identified flaws in the data transfer mechanism that had not been identified during the test. They could not have been identified during the initial test because they emerged during uses of the application that had not been envisioned initially.

### III. Implementation at the Demonstration Site

This section of the report addresses the implementation of the eAAP at HCMC (see Appendix A).

The draft and final implementation plans called for staggered introduction across eight primary care clinics at the organization—four on the main downtown campus and four located in the community. The first clinics were selected as such because they were believed to be most “ready” and receptive. However, the actual schedule was dictated as much if not more by calendars of regularly scheduled meetings of clinic staff, and also of residents. The early engagement of clinic managers proved to be a crucial step towards successful implementation.

“Implementation” involved a combination of formal presentations by the leading clinical physician on the project with clinical expertise, followed by 1-1 tutoring and hand-holding by a nurse with many years of history and experience at the organization. These presentations and meetings were supported by site-specific (e.g., outpatient, inpatient, and emergency department) tip sheets and answers to frequently asked questions. A very realistic summary of this experience was provided by the experienced nurse who conducted the training and followup sessions.

Because of the amount of time it took to develop the technology, it was not possible to perform most of the analyses previously identified in the evaluation plans. However, it was possible to assess the number of providers who used the tool, the number of patients for whom it had been invoked, and the percentage of “asthma patients” who had asthma action plans which had been completed through the eAAP. As predicted, the two general and internal medicine clinics serving adult patients had very low rates of use. The pediatrics clinics had the highest rates of use; approximately 25 percent of pediatric patients attributed to these clinics had an asthma action plan generated by the application 5 to 6 months after the application had become available. Among the family medicine clinics in the community, the rates with which patients had asthma action plans generated by the application hovered in the 14 to 16 percent range. Future analyses are being designed to determine if nonuse can be attributed to resistance to creating asthma action plans, or can be attributed to use of the computer-based technology.

## IV. Dissemination and Postcontract Sustainability

Long before the eAAP was finally introduced at HCMC, Health IT Asthma Project leads began contemplating its future once the contract with AHRQ terminated. The concerns fell into the following categories:

- Who would be responsible for responding to inquiries about the application, if it proved to be successful, and other organizations wished to adopt it?
- Who would be responsible for ensuring that its underlying clinical content remained up to date?
- Who would be responsible for responding to user suggestions about enhancements and functionality?
- Where would the resources come from to support these activities?

The Health IT Asthma Project leads knew that the organization(s) capable of assuming these functions would require stature and credibility in the pulmonary clinical community, technological sophistication, and a sufficiently robust staffing structure. The demonstration site for the project did not have these necessary characteristics, and so that stimulated the project leads to imagine an organization that did have them. They imagined that when complete, the application would be adopted by a “social host” who would be able to nurture it indefinitely.

At the same time, the project leads developed a more conventional “dissemination plan,” modeled on the lines of disseminating research findings. Since the eAAP was still being built at the time the dissemination activities were supposed to be underway, it was too soon to disseminate findings. Presentations, therefore, focused on the nature of the application, and how it differed from the currently prevalent models of electronic decision support technology. A number of these presentations were held before clinical audiences, who were intrigued by the application’s potential, and requested to be placed on a list to be notified when it was ready. In August 2009, approximately 6 weeks after the application had been launched at HCMC, project leads created a web site for it, and sent emails to individuals on the notification list. Within four weeks, the site had received approximately 100 visitors, of whom approximately 20 registered as users for the demo version on the site.

The Health IT Asthma Project never succeeded at identifying a social host. The first organization the team approached was the American Lung Association of the Upper Midwest. Their representatives felt that they neither had the technical capacity nor the mandate to perform such a function. The next organization the team approached was the National Asthma Education and Prevention Program, the group that had developed the guidelines upon which the application was based. Their primary representative did not perceive the value of the application, and appeared unwilling to take any initiative. The team then approached the American College of Chest Physicians. At the time this report is being prepared, that dialogue is underway.

Unwilling to wait for a social host either to be identified or to identify itself, the team articulated a rationale for creating tools that would enable such a host to keep the application up

to date, and tools that would enable implementing organizations to customize it for their own sites. It also presented a list of modifications intended to support an imagined “global clinical administrator” (e.g., the clinical experts located at the social host), a “global technical administrator” (e.g., the technical experts located at the social host), a “local clinical administrator” (conceived as a medical director or VP for quality at an implementing site, a “local technical administrator” (conceived as the IT support leadership at an implementing site), and clinical users. Among other things, clinical users at the initial demonstration site already had requested that the printed asthma action plan be available in Spanish, and that the application provide more navigational flexibility.

AHRQ modified the contract a second time, calling for the team to research the requirements for developing these enhancements. As the team researched the possibilities, it realized that the process through which the underlying medication content could be maintained was related to ways in which local clinical administrators could be granted adaptive flexibility in identifying treatment plans for use at their organizations, and also was related to ways to support end-users in backwards logic for automatically inferring steps and doses from medications. In fact, more than half of the modifications were tied to the mechanism for maintaining the underlying medication content, and integrating the medication content into the functioning of the application accounted for more than half of the application’s code. In other words, an automated method to keep the application up to date required at a minimum an automated method to keep the underlying medication content up to date.

Upon embarking upon the requirements for this modification of the contract, the team realized that the mechanism for keeping the underlying medication content up to date was the most crucial element to investigate. It quickly learned that the Federal Drug Administration (FDA) maintains a database called “The Orange Book.” The data entity diagram for the Orange Book shows that medication ingredients and brand names and strengths are well-described, but dosages are not present. A critical element of the eAAP was helping the user select the appropriate dosages for a selected medication (forwards logic), as well as determining current treatment step based on the dosages of the medication(s) the patient currently was taking (backwards logic). So while the FDA Orange Book—publicly available at no cost—was a useful source of information for medications available on the market, it was not a useful source of information for medication dosages. The only way to obtain dosage information was to look up ingredients and products one by one, by name, and to reenter the data found on-line into the medication database.

Anticipating that a future social host would have neither the time nor the inclination to engage in this activity, the Health IT Asthma Project team began investigating an alternative method of keeping underlying medication content up to date. This method involved working with a commercial vendor that specializes in maintaining medication information. The team established contact with sales representatives from each of the major companies in the United States for whom this is a core business activity (MediSpan, First DataBank, and LexiComp), and executed nondisclosure agreements with the latter two.

These agreements permitted the team to determine how easily the existing code could be integrated with the databases provided by one or the other of these companies. The conclusion

from this analysis was that technical integration would be relatively straightforward, but it would entail a rewrite of perhaps 50 percent of the original code. The team also concluded that such integration could not occur outside of the context of a viable business model to sustain the application over time. All the companies considered “sold” their products, typically on a subscription basis. They were willing to make their products available as support to the eAAP, but would require the end users to purchase licenses. The role of the eAAP vendor/promoter needed much greater clarity before the team could think through the implications and ramifications of this or any other particular funding model and/or business plan.

## V. Conclusions and Recommendations to AHRQ

The Health IT Asthma Project dramatically illustrated how challenging it can be to help physicians deliver evidence-based medicine in ways that to them appear simple and intuitive. The challenges are cognitive, technical, administrative, and financial.

Cognitive challenges emerge when scrutinizing evidence-based guidelines to determine how they can be operationalized during the delivery of medical care. The Health IT Asthma Project learned that in this instance, the guidelines often failed to provide the kind of support that physicians most need when they are actually performing clinical work. The team recommends that new criteria for guideline quality be developed, which include the ability to operationalize recommendations while performing medical work.

Technical challenges that are not associated with converting narrative guidelines into clinical decision support have less to do with creating the support than making the support intuitively available while clinicians are delivering care. The Health IT Asthma Project did succeed at establishing a mechanism through which clinicians could invoke the electronic decision support tool while engaging in a patient encounter supported through Epic, a commercially available electronic health record system. However, the team subsequently learned that it had not anticipated all the contexts in which clinicians might invoke the tool, and in the absence of context information, it became challenging to interpret the data that were generated. Since users invent their own contexts as they adapt to technology (and adapt the technology to themselves), it may never be possible to anticipate everything, and prepare for them in data capture mechanisms. The Health IT Asthma Project had the advantage that the interface with the EHR system was relatively “light,” and not overly engineered, which made it possible to adapt to new unexpected information. This insight leads to a recommendation that AHRQ reconsider the investments it has made over the past decade or more in creating very heavily engineered systems intended to computerize guidelines and bring them to the point of care.

The ability to ensure that the findings from the Health IT Asthma Project have a long-term positive impact is hampered by administrative and fiscal challenges that the project team faced, when it considered what would happen with the technology once the contract terminated. The team became aware that software is a product with a very short shelf-life, and that it only remains useful to the extent that it is being maintained. For clinical decision support software, maintenance needs are of two basic types. One type is technical—modifying the software in response to user feedback about functioning, screen displays, etc. The other is content. When providing clinical decision support, the underlying clinical content must reflect current clinical conditions or it will be less that useful at best and perhaps harmful at worst. Resources are required to perform these ongoing maintenance activities, yet the contract under which the original technology was developed does not provide these resources.

While it is possible to imagine ongoing resources being provided through subsequent grants and contracts, the Health IT Asthma Project team did not consider this a viable business model

for ongoing support. The primary obstacle is the time it takes to prepare proposals to win grants and contracts, and the uncertainty that even with that expenditure of time, resources will be forthcoming. The Health IT Asthma Project team reached the conclusion that the only viable business model capable of maintaining the application over time, and thus keeping it alive and enhancing its ability to have an impact on care, was a commercial one. Yet issues surrounding licensure and ownership of a product developed under a federal contract have impeded the ability to move forward with commercialization. The Health IT Asthma Project recommends that the agency dedicate some focused attention to this issue of long-term sustainability of technologies that are initially developed with its resources.

The Health IT Asthma Project team expresses gratitude to AHRQ for its support and creativity, and especially expresses admiration for our Task Order Officer, Robert Mayes. Mr. Mayes consistently supported the team through its ups and downs and maintained a positive vision that valuable information and insights were being gleaned throughout the project, especially when confronting obstacles.

# Appendix A: Final Implementation Plan

## I. Literature To Outline the Problem and Existing Efforts To Address the Problem

Asthma is one of the most common chronic diseases in the United States. In America, 15.7 million people currently have asthma, including an estimated 6.5 million children under the age of 18. Asthma disproportionately impacts people of color, especially women, children, and the poor. Asthma can range from relatively mild to quite severe, and is the third leading cause of hospitalizations in children under 15. Asthma is associated with missed school days, missed workdays, disrupted sleep, and symptoms that interfere with physical activity. It can be fatal. In 2004, asthma accounted for nearly 500,000 hospitalizations and 1.8 million emergency department visits across the country. In 2003, 4,099 people died of asthma. Analysis of asthma prevalence and hospitalization data suggests that the trends in Minnesota parallel those seen in the rest of the country: children, women, and inner city urban populations are at highest risk for asthma morbidity. The asthma hospitalization rates for children under 5 in Minneapolis are almost 50 percent higher than the national rates for that age group.

While it cannot be cured, asthma can be controlled and managed by adequate access to medical care, appropriate use of medications, trigger avoidance, and self-management. In response to a recommendation by the National Asthma Education and Prevention Program (NAEPP) Coordinating Committee, an Expert Panel was convened by the National Heart, Lung, and Blood Institute (NHLBI) to update the 2002 clinical practice guidelines for the diagnosis and management of asthma. The new asthma guidelines were released August 2007 as the Expert Panel Report-3 (EPR-3).<sup>2</sup>

In its report, the EPR-3 recommends that clinicians provide their asthma patients with tools that will help them self manage their condition. These tools include asthma information and training in asthma management skills; self-monitoring; regular assessment by a consistent medical provider; and a written asthma action plan for daily treatment and self-management of exacerbations or symptom episodes. The latter is particularly important for those with moderate or severe asthma, a history of severe exacerbations, or poorly controlled asthma.<sup>3</sup>

Additionally, many quality improvement studies have shown that guideline-based practice will standardize and improve the quality of care given to people with asthma resulting in improved outcomes. The EPR-3 specifically recommends that a key focus of provider education include the development, implementation, and evaluation of system-based interventions to support clinical decisionmaking to support quality care for asthma.<sup>2</sup>

In efforts to determine what methods are most likely to change clinician behavior towards guidelines adherence, studies show that multifaceted approaches work best. Research regarding the use of Electronic Medical Record (EMR) systems to facilitate guideline-based practice is

relatively new, and the methods used to promote practice changes and adherence varies widely. Most “interventions” involve the use of “pop-up” reminders that are annoying and disregarded when there are too many of them. These commercially available options may prompt the provider to change one aspect of care but do not promote and facilitate patient education while incorporating guideline based management.

## II. Target Population/Condition

### Target Population Receiving Asthma Care

The primary purpose of the intervention is to improve the quality of asthma care delivered to patients seen in the HCMC/HFA clinic system. HCMC serves a predominantly low-income, vulnerable, diverse patient population, the groups in which asthma prevalence and incidence rates are the highest, and in which the consequences of asthma are most severe.

**Table 1. Patients at HCMC diagnosed with asthma in CY 2005**

Number of patients and patient-encounters at HCMC in CY 2005 with a primary or secondary encounter diagnosis of asthma					
Inpatient: Unique patients	Inpatient: Admissions	Outpatient: Unique Patients	Outpatient: Registrations	Emergency/ Urgent Care: Unique Patients	Emergency/ Urgent Care: Registrations
1,835	2,390	12,461	23,379	6,152	8,673

### Target Population for Intervention

The target population for this intervention is the medical providers who deliver asthma care.

Assessment of initial asthma severity, and subsequent determination of asthma control according to NAEPP guidelines, should guide the provider to prescribe the appropriate medications in order to help patients achieve good asthma control. There is a large body of evidence suggesting that medical providers have limited ability to practically incorporate the asthma guidelines into their clinical practice. This negatively impacts patient care by delaying recommended levels of treatment. Initial measures at HCMC indicate that medical providers are using NAEPP guideline measures 5 to 50 percent of the time. Patients who rely on short-acting beta agonists (due to poor asthma control or inadequate assessment of severity) have higher likelihoods of acute asthma exacerbations that require intervention in an emergency department and/or an inpatient hospitalization, both of which are traumatic for the patient and costly to the health care system.

### **III. Target Clinical and Systemic Goals**

#### **Target Clinical Goal**

Every HCMC patient with asthma will be treated according to the NAEPP asthma guidelines. This includes receiving a written asthma action plan to help facilitate disease self-management.

#### **Target Systemic Goal**

To maximize the extent/penetration to which the IAAP is utilized by clinicians in the delivery of asthma care. To achieve these goals, the project will—

1. Support the work of physicians during the normal clinical workflow, by giving them direct access to the specialized functionality of a redesigned Interactive Asthma Action Plan that is consistent with Expert Panel 3 guidelines. The access will be available during a patient encounter, taking advantage of both the specialized asthma functionality of the IAAP, plus the system-wide integrated functionality of the EMR.
2. Support the work of an existing asthma quality improvement team (AIG) by using the EMR to generate regular reports of process outcomes for the HCMC asthma patient population.

### **IV. Plan for Adapting Available Health IT To Address Problem**

This project intends to improve asthma care through enhanced provider decision support, and asthma self-management through the use of a patient-friendly written asthma action plan, by integrating a standalone decision-support and asthma action plan tool into a commercially available electronic health record system.

#### **Integrate the IAAP Into the Epic Clinical Workflow**

The EHR system at HCMC must be modified so that the IAAP can be integrated into it. Integration requires cooperation from the HCMC IT department (to secure the time of the HCMC database administrator, and to secure space on the HCMC server), and the HCMC Epic team (to build the functionality that enables the user to launch the IAAP from within the Epic workflow. The project team will make a formal request for these resources no later than April 30, 2008. To make the formal request, the project team needs—

1. A complete Technical Specifications Document from the technical consulting firm that is preparing the redesigned IAAP. This document will describe the underlying database/registry in technical detail, which will provide the HCMC DBA and the HCMC

IT hardware manager with the information they require to estimate the dollar value of the resources requested.

2. A plan for how the IAAP will be invoked from within the clinical encounter.

Technically, integration requires the construction of an asthma population registry. The registry enhances the existing database that now accompanies the IAAP. It will contain records of all HCMC asthma patients, where the operational definition of an ‘asthma patient’ will be created using criteria established by the American Lung Association. Variables in the registry include the patient demographics and previous visit data required for utilization of the IAAP, plus new asthma-specific information captured during the provider’s interaction with the IAAP.

If the patient being seen by the provider already has a record in the registry when the provider invokes the IAAP, the interface will automatically populate the IAAP with relevant data from the registry. If the patient does not have a record in the registry, a new one will be created. Text and image data generated through the interaction with the IAAP (e.g., physician notes, list of medications chosen, and written asthma action plan) will be stored as text and image files in the patient’s medical record; someone from the system will manually enter all the discrete data that are stored in EMR searchable fields (e.g., medication orders, severity diagnostic codes).

The registry serves three purposes: (1) provide support to the clinician during the clinical encounter, (2) allow quality improvement teams to monitor changes in the care given to the total asthma population, and (3) generate the quantitative data used in the evaluation of this project.

## **V. Pilot and Final Implementation Sites, Project Champions, and Implementation Activities**

In January 2006, HCMC established a disciplined quality improvement initiative in ambulatory asthma care, consistent with procedures established by the Institute for Clinical Systems Improvement (ICSI).<sup>2</sup> Ten ambulatory sites (6 on the hospital main campus and 4 in the community) were targeted for the initiative. An Asthma Implementation Group (AIG) comprised of representatives from each site was formed and charged to carry out the QI initiative. Work of the AIG is supported by an HCMC Performance Improvement Specialist.

The HIT intervention developed for this project will be available at all sites; it will formally be implemented (including training, designated champions, and included in the evaluation) at all sites except the Urgent Care Clinic and the Emergency Department. Four of the sites will pilot and test the intervention before it is formally implemented to ensure that all the “bugs” have been worked out of the system.

**Table 2. Sites included in the HCMC asthma QI initiative for ambulatory care and their roles**

Site	Type of site	Location	Role in Project: Pilot	Role in Project: Training	Role in Project: Implement	Role in Project: Evaluate
General Medicine Clinic	Adult & child general medicine	Main hospital campus	▪	▪	▪	▪
Internal Medicine Clinic	Adult general medicine	Main hospital campus	▪	▪	▪	▪
Family Medical Center	Adult & child general medicine	Community	▪	▪	▪	▪
Hennepin Care South	Adult & child general medicine	Community		▪	▪	▪
Hennepin Care North	Adult & child general medicine	Community		▪	▪	▪
Hennepin Care East	Adult & child general medicine	Community		▪	▪	▪
Pediatrics Clinic	Child general medicine	Main hospital campus	▪	▪	▪	▪
Pulmonary Clinic	Specialty clinic	Main hospital campus		▪	▪	▪
Urgent Care Clinic	Adult & child urgent care	Main hospital campus			▪	
Emergency Department	Adult & child emergency care	Main hospital campus			▪	

Implementation activities occur in the following stages: Building institutional support, testing, training, and then implementation.

## Build Institutional Support

Dr. Brottman, Principal Investigator, is building institutional support among the organizational leadership at Hennepin County Medical Center (HCMC) and the multispecialty physician practice group that serves HCMC - Hennepin Faculty Associates (HFA). During the first two months of the project, she accepted invitations to present information about the project to three different standing meetings of organizational leaders:

- Medical Executive Committee, a standing committee that is comprised of the Department Chiefs, medical directors, chief nursing officer and the HCMC CEO. The committee acts as the policymaking body for the Medical Staff as a whole.
- Interdisciplinary Quality and Safety Committee, which reports to the Joint Strategy Team. The primary responsibility of this committee is to identify, prioritize, select, direct, implement and evaluate organizational improvement and safety initiatives.
- The ICSI (Institute for Clinical Systems Improvement) Core Team, a group that serves as the liaison between HCMC and the Minnesota-based membership organization for quality improvement in medical care.

Additionally, members of the AIG are alerting clinic staff to the impending project and generating enthusiasm and excitement for it.

## Testing

Members of the AIG will test the interface between the redesigned IAAP and the Epic clinical workflow during May 2008. Testing will not only provide necessary feedback to HIT developers, it also will build understanding of and support for the intervention.

## Training

Actual implementation will begin by training clinic staff in the use of the newly developed technology. The Implementation Manager will arrange all training sessions and also conduct them. It will take 2 to 3 months to train all staff in all clinics, allocating 2 hours of training conducted in a single week for each staff member, where training sessions hold up to 25 individuals. The AIG determined the order in which the intervention will be introduced into the clinics, anticipating that the greatest overall adoption will be achieved if the most enthusiastic clinics adopt it first. The anticipated training schedule is shown in Figure 1 below.

**Figure 1. Site Training Schedule**

Type of Site	Location/ Site	Champion	Dates
Pilot Sites	HCMC Pediatrics-Apples	Gail Brottman, M.D.	June '08
Pilot Sites	Family Medical Center- Purple Team	Allyson Brotherson, M.D.	June '08
Pilot Sites	HFA, Internal Medicine	Michelle Johnson, M.D.	June '08
Pilot Sites	Medicine Clinic- Firm "A"	Ellen Coffey, M.D.	June '08
Initial Implementation Sites	HCMC Pediatrics – Bananas	Gail Brottman, M.D.	July '08
Initial Implementation Sites	Family Medical Center- Red Team	Lora Koepp, P.N.P.	July '08
Initial Implementation Sites	Hennepin Family Care, East Lake Clinic, Brown Team	Marie Kaefer, M.D.	July '08
Initial Implementation Sites	Hennepin Care South	Natalie Hayes, M.D.	July '08
Initial Implementation Sites	Medicine Clinics	Luann Johnson, N.P.	July '08
Initial Implementation Sites	HFA, Pediatrics	TBD	July '08
Initial Implementation Sites	HCMC Emergency Dept.	Steven Smith, M.D.	July '08
Final Implementation Sites	Family Medical Center- Orange Team	David Councilman, M.D.	August '08
Final Implementation Sites	Hennepin Family Care- East Lake Clinic- Gold Team	Carlos Figari, M.D.	August '08
Final Implementation Sites	Hennepin Care North	Hyder Khan, M.D.	August '08
Final Implementation Sites	HCMC Urgent Care	Joni Kopitzke, N.P.	August '08
Final Implementation Sites	HCMC Pulmonary Clinic	Conrad Iber, M.D.	August '08

## VI. Timeline of Activities and Major Milestones

The overall timeline and major milestones for all activities taken together are shown in Figure 2.

**Figure 2. Milestones and Timeline**

Aspect of Project	Milestone/Activity	Milestone Completion Date
Build institutional support – system leadership	Give presentations about project to organizational leadership	At least three presentations by December 31, 2007
Create interface between IAAP into Epic clinical workflow	Transmit design of asthma population registry to developers	May 2008
Build institutional support – clinics	Pilot site warm-ups* complete	May-June 2008
Build institutional support – clinics	Initial implementation site warm-ups* complete	June-July 2008
Implementation	Training at all initial implementation sites complete	Early July 2008
Implementation	Implementation at all initial sites complete	Late July 2008
Build institutional support – clinics	Final implementation site warm-ups complete	July 2008
Implementation	Training at final implementation sites complete	Early August 2008
Implementation	Implementation at final implementation sites complete	Late August 2008

\*Warm-up” means Principal & Coinvestigator will meet with medical directors, clinic managers, nursing staff at each clinic to build enthusiasm for project and secure buy-in. Warm-up also conducted by the standing ICSI (Institute for Clinical Systems Improvement) Asthma QI Team, comprised of representatives from each site who have been meeting monthly since May 2006.

## References

1. National Heart Lung and Blood Institute and National Asthma Education Program. Expert panel report: guidelines for the diagnosis and management of asthma—update on selected topics 2002 (EPR - Update 2002). 2003.
2. National Heart Lung and Blood Institute and National Asthma Education Program. Expert panel report 3: guidelines for the diagnosis and management of asthma--Full Report, 2007. p. 95.
3. Institute for Clinical Systems Improvement (ICSI). Executive summary - March 2005. diagnosis and management of asthma. 2005. p. 1.