## AHRQ Safe Practices Implementation Challenge Grants Program

## Final Progress Report

# Title Page

**Project Title:** The PeaceHealth Community-wide Electronic Shared Medication List

**Principal Investigator:** Ronald D. Stock, MD (PeaceHealth System)

**Team Members:**

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|---|---|---|
| Susan Easton | PeaceHealth System | Co-Principal Investigator |
| Jim Scott, MD | PeaceHealth System | Executive Sponsor |
| Linda Center | PeaceHealth System | AHRQ Project Manager |
| Dawn Gauthier | PeaceHealth System | Technical Design Leader |
| Bill Mahoney, PhD | PeaceHealth System | Project Evaluation Leader |
| Marc Pierson, MD | PeaceHealth Whatcom Region | Whatcom Project Leader |
| Mary Minniti | PeaceHealth Whatcom Region | Whatcom Project Manager |
| Lori Nichols | HINet | Director, Whatcom County |
| Sherry Catlin, DO | PeaceHealth Siuslaw Region | Siuslaw Project Leader |
| Carol Boston-Fleischauer | PeaceHealth System | Process Improve Leader |
| Michael Sheehan | PeaceHealth System | Web Services Director |

**Organization:** PeaceHealth is the healthcare ministry of the Sisters of St. Joseph of Peace that operates hospitals and medical clinics in five regions of Washington, Oregon, and Alaska. This project included the PeaceHealth system office located in Bellevue, WA, and three PeaceHealth regions: PeaceHealth Oregon Region in Eugene, OR; PeaceHealth Siuslaw Region in Florence, OR; and PeaceHealth Whatcom Region in Bellingham, WA.

**Project dates:** October 1, 2003, through September 30, 2006

**Federal Project Officer:** Deborah Queenan

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# Abstract

**Purpose:** To improve patient medication safety in the outpatient community by utilizing a single, updated, shared medication list that is accessible both electronically and manually to those involved in the care of the patient.

**Scope:** The project provided access to medication lists for the patient and all caregivers in a variety of settings. The medication lists were integrated into the clinical office workflow process. A single accurate medical list was created electronically by integrating data from the Shared Care Plan, a web-based personal health record, and other electronic records. The system provided access to documented patient goals and Advance Directives. This information was made available to the patient and community care team members chosen by the patient.

**Methods:** Utilize current technology and innovation as necessary for interfaces to disparate EMR systems. Lead, train, and motivate healthcare professionals and patients to clearly communicate changes to the medication regimen, document, and share the accurate, updated information with all those involved in the patient's care. Utilize qualitative and quantitative evaluation methodologies to assess impact of interventions.

**Results:** Three outpatient clinic sites and 108 adult patients were involved in the study resulting in improved accuracy of patient medication lists as documented in monthly discrepancy data collection. Standardized clinic medication management processes were implemented. Initially, patients had perceived that providers knew more about their medication plan than was actually true. Overall, health system leadership support was significant, clinic medication safety culture improved, and patients found the electronic medication list beneficial.

**Key Words:** medication safety; medication reconciliation; personal health record

## Purpose

The project goals were accomplished through three objectives:

1. To develop a single, updated, and reconciled medication list and care plan that is electronically and manually accessible to patients and their caregivers, physicians, alternative care practitioners, clinics, hospitals, home health, nursing home, and others who participate in the care of each patient.
2. To develop a medication reconciliation process between the patient, clinic, and other healthcare providers or care settings.
3. To measure perceptions of patients and clinicians about safety and satisfaction with the new electronic tools, measure use of the electronic tool by patients and clinicians, measure the degree to which medication discrepancies occurred in the clinic setting, and use focus group interviews of observers to analyze the impact of the process on culture change.

From as many source systems as possible, including the patient, the intent was to collect information on one page that would allow healthcare professionals to better identify and document within their system exactly what medications the patient was taking. Initially, a Shared Medication List (SML) was developed within the Shared Care Plan (SCP) that provides medication information from the patient's Primary Care Physician (PCP) electronic medical record (EMR), community specialists' EMR, and the patient's documentation via a single web page. This web page is called Meds on Record (MOR) and is available within the SCP Shared Medication List as well as in interfaced EMRs in the clinician office. Additionally, because there is recognized value in showing allergies and intolerances when prescribing medications, that information is also available to healthcare professionals through MOR. The medication list includes prescribed medications as well as non-prescribed medications. This project also developed functionalities within the Shared Care Plan for patients to document their personal health goals and store electronic copies of their Advance Directive.

## Scope

PeaceHealth is an integrated health system that operates hospitals and clinics in five regions of Washington, Oregon, and Alaska. In 1990, the PeaceHealth executive leadership set out to develop a sophisticated information management system that supported a standardized electronic medical record shared by each of its healthcare facilities. Once that system was established, non-PeaceHealth providers in each of the PeaceHealth communities were invited to connect with this existing EMR. During the past decade, PeaceHealth has made a concerted effort to develop new tools and software programs that electronically provide essential medical information in the right form, to the right place, at the right time.

In 2002, PeaceHealth, on behalf of the Whatcom County Community Health Improvement Consortium, was awarded a grant from the Robert Wood Johnson Foundation Pursuing Perfection initiative to create innovative chronic care services focused on strengthening patients' ability to manage their own care as well as to create a more effective community healthcare system. One of the outcomes of that project was the Shared Care Plan (SCP), an easy-to-use, online personal health record that was designed with feedback from patients and healthcare professionals. One feature of the Shared Care Plan is a medication list maintained by patients, who then share that information with their family and healthcare professionals.

There is clear evidence that thousands of deaths and injuries occur annually in hospitals due to preventable medical errors and that a leading cause of these errors is preventable drug reactions (*To Err Is Human: Building a Safer Health System,* Institute of Medicine, 2000). In a recent IOM report (*Preventing Medication Errors,* Institute of Medicine, 2006), it is noted that medication errors that lead to adverse drug events are as frequent, or more frequent, in the ambulatory setting. The report clearly states that a key approach to developing and maintaining a safe medication management system is to establish a strong clinician-patient relationship. Other recommendations include improving patient medication self-management and information availability, developing a culture of medication safety in the healthcare setting, and using health information technology to improve the safe management of medications.

Relatively little is known about the adverse drug effects that occur in the ambulatory setting. It is assumed that accurate management of the medication list in the ambulatory setting will result in fewer medication errors across the continuum of care. A fundamental problem in the outpatient setting occurs when a clinician does not have immediate access to an accurate list of the medications that a patient is taking. This project is based on the premise that creating an accurate medication list and making it available at *each* encounter within the healthcare system, regardless of the location of care, will dramatically enhance patient safety. It is believed that access to accurate information is a serious gap that prevents providers from delivering optimal healthcare services and reducing medical errors. The challenge is to implement reliable medication safety practices in every outpatient setting and across the care continuum.

## Methods

Both quantitative and qualitative methodologies were used to assess the impact of the community-wide electronic shared medication list. Objective medication list accuracy outcomes as well as perceptions of patients and clinicians on safety and satisfaction with the tools were explored.

Three ambulatory care clinics were chosen to participate in the study based on their interest in improving medication safety and experience in quality improvement projects. One site, the Center for Senior Health in Bellingham, Washington, was a participant in the RWJF Pursuing Perfection initiative in which the Shared Care Plan was initially developed. The following clinic sites participated in the study:

1) Senior Health and Wellness Center (SHWC) in Eugene, Oregon, with four geriatrician providers;
2) Center for Senior Health (CSH) in Bellingham, Washington, with seven adult medicine and geriatrician providers; and
3) Health Associates Peace Harbor (HA) in Florence, Oregon, with 13 adult care providers.

SHWC and CSH quality improvement teams included participants from all levels of clinic staff: providers, clinic manager, nursing, and reception. The SHWC team actively recruited and included patients on their Quality Improvement process team. The HA team engaged a more diverse team approach that included clinic administration, quality manager, pharmacy tech, clinical assistants, and IT. This team did not include a clinic provider or patients. Each team met once a month and the SHWC team met bi-monthly.

### Objective 1: To develop a single, updated, and reconciled medication list and care plan that is electronically and manually accessible to patients and their caregivers

During the clinic process-mapping phase for medication reconciliation and management, technical development of the tools occurred simultaneously. The design questions were: 1) How can technology support the medication reconciliation process? 2) How can existing medication and allergy data be shared? 3) How can PeaceHealth build on what has already been learned? To answer these questions, a user-centered design methodology was employed in which the tasks, needs, wants, and limitations of the end users of a system are given extensive attention at each stage of the design process. This process resulted in a proposed tool dubbed "Meds On Record," an online medication list accessible to both patients and providers that contains all available electronic medication and allergy data for that patient in a single display.

“**Meds On Record” functionality.** With patients entering data into their Shared Care Plans and healthcare professionals entering data into their EMRs, it was possible to build interfaces to the participating systems in order to create the Meds On Record view (see Figure 1). The participating healthcare entities and their respective clinical systems were:

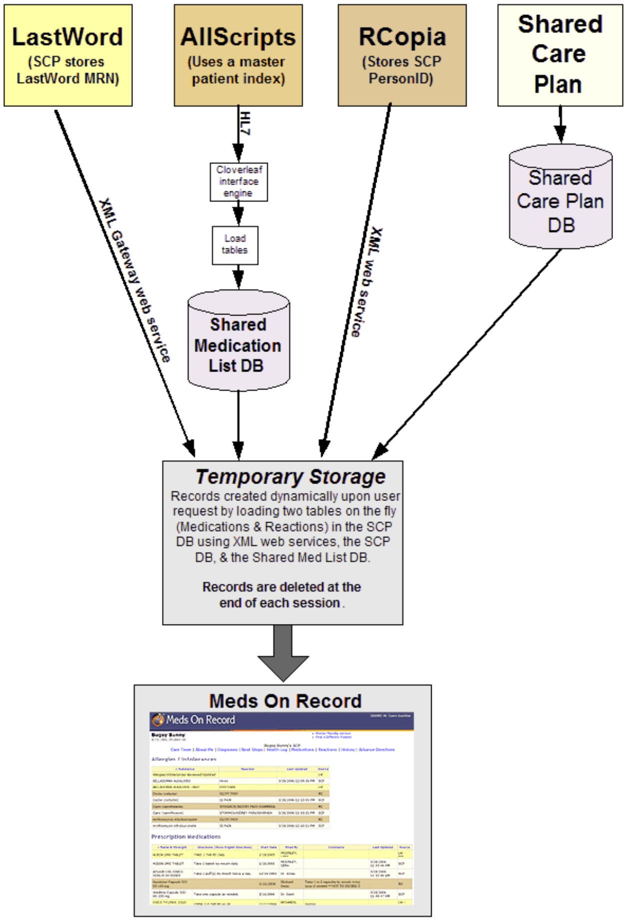
- PeaceHealth, using GE/IDX LastWord
- Oregon Cardiology, using AllScripts Medications
- Three independent clinics in Whatcom County, piloting Dr First RCopia

The LastWord and RCopia interfaces were built using XML web service technology to pull real-time data from source systems instantly upon user request. The AllScripts interface utilized HL7 messages sent through an interface engine and then stored in a database each night. As a best practice for privacy and security, the database that brings together all the sources for display in Meds On Record deletes all data after each individual user session.

To match patients among the different systems, an existing master patient index that included both PeaceHealth and Oregon Cardiology data was used to match patients among the Shared Care Plan, LastWord, and AllScripts. RCopia used demographic data from the Shared Care plan to match patients in its system and then store the patients' unique Shared Care Plan IDs in the RCopia system.

Patients accessed Meds On Record through their Shared Care Plans, whereas healthcare professionals accessed it from a web link within their clinical systems. In the LastWord system, healthcare professionals received notification by a pop-up alert whenever they activated a patient who was participating in the project. This made it easier for clinicians to remember to implement the process of medication reconciliation using the Meds On Record tool for these patients. Patients could also print their medication list and personal health information in a wallet-sized format that they could carry with them.

**Figure 1**



**"Next Steps" functionality.** Next Steps, or documentation of patient health goals, was the second deliverable of electronic functionality. The vision was that patients would be engaged in their own health maintenance by thinking about their life and/or health goals and then identifying ways to achieve them. The patients recorded their goals and tracked progress in their Shared Care Plans. This information would also help providers focus on what was important to the patient.

**"Advance Directive" functionality.** The third deliverable was digitizing Advance Directives for online viewing. The technical team purchased barcoding software and developed a fax-in process to digitize and store the Advance Directives documents in patients' Shared Care Plans. The technology used a barcode on the fax cover page (printed from the SCP) that identified the specific patient's SCP. The faxed document appeared in the SCP under the Advance Directives tab as soon as the fax was successful. For quality assurance purposes and resource management, there was no human intervention unless the patient asked the clinic to send the fax for them.

**Objective 2: To develop a medication reconciliation process between the patient, clinic, and other healthcare providers or care settings.**

The three pilot site teams mapped current medication reconciliation processes at the beginning of the study and then identified best practices in medication reconciliation as the goal and worked toward achieving that goal. At the time of process mapping, the electronic tool was not used but was considered later for the best practices process design. The SHWC team was most successful using small steps of change. Newly defined processes were implemented at the practice level with one provider and one nurse plus full participation of the receptionists and patients. The HA group had been working on medication list reconciliation for 2 years, therefore requiring integration into an already re-engineered medication process. The CSH was undergoing reorganization and a physical site move early in the study but was fully participating in process re-design by early summer 2005.

As study participants, patients at the three sites were asked to maintain an accurate medication list in their Shared Care Plans. Through interview processes and participation from patients in the quality improvement teams, a better understanding of patient and caregiver use of the SCP and Med List functionality helped the clinic team understand how to integrate the clinic's medication management process with the patient's.

**Objective 3: Study Evaluation**

The evaluation phase included six measures:

1. **Ambulatory Medication Safety Culture Survey**: An ambulatory focused survey (Mahoney and Stock, 2004) measuring the degree to which a culture of medication safety is present in a clinic was developed using components of the Institute for Healthcare Improvement (IHI) safety culture survey and the AHRQ hospital-based safety culture survey. Baseline data was collected for three clinics prior to intervention, in June 2004 for two clinics and in August 2004 for the third. A follow-up survey occurred in June 2005 for all clinics.
2. **Patient Experience with the Shared Medication List (PESML) Survey:** Each clinic was asked to recruit 35 patients older than age 18 years as active participants in process improvement and design as well as for data collection purposes. IRB approval was obtained, authorization and informed consent documents were collected, and patients were identified to participate on teams. Patients were registered into the Shared Care Plan and trained on use of the tool and study expectations. A telephone survey was conducted to solicit individual patient information about their experience of using the shared medication list and SCP 60 days after signing up for the Shared Care Plan (Mahoney, 2005).
3. **Patient Satisfaction Survey:** PeaceHealth regularly conducts a patient satisfaction survey with a probability sample of patients following an office visit. Two questions were added for patients from the participating clinics to evaluate the patient's perception of medication safety. These questions evaluated the patients' perception of provider knowledge of medications that the patient was taking.

4. **Medication List Discrepancy Measure**: This measurement tool was developed to measure the extent of medication discrepancies between what the patient is taking and what is documented in the medical record. Using a standardized tool and process (Stock and Mahoney, 2003), a sample of 15-30 patients at each of the three primary care clinics was randomly selected at baseline (pre-intervention), and then a new sample was chosen monthly to measure the percentage of medication discrepancies. The clinic intervention included a standardized office practice medication reconciliation process, the introduction of the SCP electronic Medication List tool, and attention to improvement of med safety culture within the practice.
5. **Focus Group and Observational Review**: An experienced outside consultant was hired to query the AHRQ Leadership Oversight Group. The goal was to qualitatively document the leadership team's perceptions of this project and change as a result of the project. This group included the regional executive sponsors, leadership, and project management (both technical and process). A baseline focus group was conducted September 15, 2004, with a follow-up conducted June 15, 2005. Additionally, interviews and observations of patients, caregivers, healthcare professionals, clinic staff, and technical support staff were recorded throughout the study.
6. **Staff and Patient Usage Report (Website "Hits" data):** As an indicator of use and perceived value, this report shows how often individual categories or pages were used within the Shared Care Plan in the cohort of patients recruited in the three pilot site clinics.

## Study Limitations

By design, this study was limited to adult patients who had direct access to a computer and cognitive skills to understand use of the computer, register (with assistance), login to the Shared Care Plan, look at information included within the Shared Care Plan, and enter data. Patients without computer skills or access were not included in this study.

Patients recruited into the study to use the SCP were not randomized into study group cohorts. There was no control group in the evaluation. The unit of analysis for most of the evaluation methods was the clinic practice, so the intervention of introducing the SCP was experienced by a small number of patients in each clinic site. However, all staff at the sites participated in the redesign of the medication reconciliation process and safety culture interventions in their respective clinic.

There were not enough patients enrolled in the study to measure whether this intervention had any impact on reducing medication errors or adverse events. Future studies would need to randomize larger community groups to those with a SCP and med list and compare versus a group that did not have a SCP to know whether the intervention has any benefit on primary outcomes for clinic medication safety.

Two of the three pilot site clinics cared for older adult populations, some of which were high risk and vulnerable/frail. The third clinic cared for a community-based general population. Study participants were primarily Caucasian, educated, and insured. Ambulatory clinic pilot sites served small- to moderate-sized urban communities in the northwest and were part of a relatively small non-profit, Catholic healthcare system.

## Results

### Ambulatory Medication Safety Culture Survey.

The aim of this outcome measure was to determine the degree to which the staff in a clinic experiences the specific attributes of a culture of medication safety. Staff, including physicians from all three pilot primary care clinic sites, were asked to complete an online PeaceHealth Ambulatory Medication Safety Culture Survey (Mahoney and Stock, 2004). This survey was completed prior to intervention of the improved medication reconciliation process and introduction of the SCP medication list (Site 1 N=26; Site 2 N=20; Site 3 N=16) and then again 6 months after the intervention (Site 1 N=20; Site 2 N=32; Site 3 N=28).

**Survey Instrument.** Eighteen questions were constructed based on other existing safety culture surveys. These questions were psychometrically evaluated using Rasch/IRT measurement models and internal consistency reliability. Two of the 18 items had excessively large fit coefficients, indicating that they were not on the same unidimensional continuum as the other 16 items, thus measuring a different construct. The final Culture of Medication Safety measure consisted of 16 questions (using a four-point, disagree-agree response format), forming a Rasch/IRT unidimensional scale with high internal consistency reliability (Cronbach alpha = .93). The internal consistency reliability was maintained in all three clinic sites (Site 1 = .96; Site 2 = .94; Site 3 = .90).

**Item Response Difficulty.** In Rasch/IRT measurement models applied to survey data, the questions serve the same function as inch marks on a ruler or temperature points on a thermometer. Each question (in the form of a Likert-type statement) requires an empirically determined amount of the variable being measured to be agreed to. How much of a culture of medication safety has to be present to agree to the statement is referred to as the difficulty of the item. The difficulty of the items has a hierarchical structure; to have measurement of a culture of medication safety, there must be a sufficient range of item difficulties. Item difficulty provides more than psychometric information. Because the item difficulties tell us how difficult it is to put each item’s referenced component in place in building a culture of medication safety, we can learn what to expect in terms of the developmental progress in building such a culture in the clinic environment. There is evidence that culture is foundational but is not the end state. This would seem to be suggested clearly by the one item that is by far the most difficult: “In this clinic, we have defined protocols about reporting and discussing medication mistakes that almost happened and could have harmed a patient but did not.” Nearly half the staff felt a need for defined protocols for reporting and discussing medication mistakes. Approximately 20% of the staff would be concerned if a member of their family were a patient there because of concerns about possible medication errors.

**Clinic Differences and Change Over Time.** To evaluate differences between the three clinics and change over time in the culture of medication safety, a univariate general linear model analysis was conducted on culture of medication safety scores. Clinic and year (2004, 2005) were fixed factors, with no covariates.

There was a significant between-subjects effect for clinic (F = 9.65, p < .0001) and year (F = 17.5, p < .0001), and there was a significant clinic-by-year interaction (F = 14.28, p < .0001). The nature of the interaction is that Clinic 1 and Clinic 2 significantly improved in the culture of medication safety from 2004 to 2005, but there was no significant change in Clinic 3 (95% CI). At baseline in 2004, there were no significant differences between the three clinics, but in 2005, both Clinics 1 and 2 had a significantly higher culture of medication safety score than did Clinic 3 (95% CI).

**Patient Experience with the Shared Medication List (PESML) Survey.** To assess patients' experiences with the SCP medication list, 104 patients (SHWC=38; CSH=34; HA=34) were recruited, informed consents were obtained, and patients subsequently were trained to use the SCP. Of all consented participants, 61 (SHWC=26; CSH=17; HA=18) accessed their SCP within 60 days of signing up for participation. A completed telephone survey was obtained from 51 (SHWC=26; CSH=15; HA=10) of these participants. Only patients who had accessed their SCP were contacted for the telephone survey.

There were 19 survey questions. It is notable that, with most questions, a rather large minority did not respond (don't know, no answer). This is not particularly unexpected, because an electronic shared medication list that is controlled by the patient is a new idea; thus, it may take time for patients to make up their mind about the behavior addressed by many of the questions. The majority of these no responses came from those patients who had accessed their SCP yet had not gone online to access the medication list functionality. The following is a summary of the telephone survey responses:

- A majority of patients reported going online to look at their medication list.
- Most patients say they would indicate on the medication list if they were not taking a prescribed medication and would report herbals and other over-the-counter supplements.
- Of those patients who have accessed their medication list:
    - An equal number of patients never take a printed copy of their medication list to a primary care physician visit or always take a printed copy to a primary physician.
    - Patients are more likely to take a printed copy of the medication list to providers other than their primary care physician.
    - A large majority of patients found the Shared Care Plan easy to access and the medication list easy to use, read, and print.
    - A large majority of patients felt that having a medication list makes them more confident that they are taking their medications correctly and felt that their primary physician knows what medications they are taking.
    - A smaller majority of patients thought that having a medication list makes them confident that, wherever they go for healthcare, the providers will know what medications they are taking and they will not be given a medication they should avoid.
    - 97% of patients said that having their medication list makes it easier for them to take an active role in their healthcare.

  - 90% of patients said that having a medication list improved the communication between themselves and their healthcare provider.
  - 83% of patients said that having a medication list made them more aware of the possibility of medication errors, and the same percentage said it reduces their fear that a medication mistake will be made.

**Staff and Patient Usage Report.**

A key question in this exploratory analysis is the degree to which study participants with an electronic personal health record, the Shared Care Plan, used the medication list monitoring tools and functionality. This was measured counting the number of times ("hits") the participants accessed these tools over a 6-month period.

The Shared Care Plan (SCP) contains three components relevant to medications: *My Active Medications,* where the patient sees the downloaded medications from the Meds on Record and records the medications they are currently taking; *Discontinued Medications*, a record of medications they are no longer taking; and *Medications on Record*, where the patient can view the medication list found in their physician's EMR as well as their own SCP medication list.

In total, 76 patients participated by acquiring Shared Care Plans. Each patients' SCP could be accessed by a person in different roles: the patient, a health professional, a care team member other than the patient or healthcare professional, and "other." These 76 SCPs were accessed a total of 957 times over the course of 6 months. Of these 957 hits, 40.6% were by patients, and 46.4% were by a health professional.

Of the 389 hits to the SCP made by patients, 18.5% were to active medications. Healthcare professionals and care team members accessed the "Active Medications" function equally, at 11%. Care team members accessed the Medications on Record function more frequently than did either the patient or the healthcare professional. The discontinued medications function was accessed equally by patients and care team members but was not accessed at all by the health professionals.

**Patient Satisfaction Survey.**

Overall, 486 patients answered two questions about their perception of providers' knowledge of the medications they were currently taking through a patient satisfaction telephone survey. These patients were from all three clinics. Within one clinic, patients were from eight different care teams within the clinic (one orthopedics team, three family practice teams, two internal medicine teams, one general surgery team, one OB team). Overall, patients were very confident in providers' knowledge about current medications being taken; 95.8% of patients agreed or strongly agreed with the statement, "I am confident that my primary provider knows all of the medications I am currently taking," and 62.1% of patients strongly agreed with this statement. Although confidence in providers other than the primary care provider was also high, it was notably lower than for the primary care provider; 92.6% of all patients agreed or strongly agreed, "I am confident that all of my healthcare providers OTHER THAN MY PRIMARY DOCTOR know all of the medications I am currently taking," and 45.6% strongly agreed. These rates of confidence did not significantly differ by clinic or by team within the one clinic with multiple teams. Answers to these two confidence questions were not related to age or gender of the patient. Testing differences in mean confidence rating of patients surveyed in different months (January, 2005 to June 2005) showed no difference in confidence rating by month (F < 1 for both questions).

**Medication List Discrepancy Measure.**

The aim of this outcome was to measure the degree to which the medications that the patient is taking is known by the primary care physician or practice where the patient receives care. The hypothesis is that the number (percent) of medication discrepancies between the practice medical record and what the patient is actually taking will be less after the intervention.

Using a standardized tool and process (Stock and Mahoney, 2003), a sample of 15-30 patients at each of three primary care clinics was randomly selected at baseline (pre-intervention), and then a new sample was chosen monthly to measure the percentage of medication discrepancies.

**Percent of Medications Discrepant.** A total of 901 patients from three primary care clinics participated. The percent of total listed medications for a patient that were discrepant served as the primary variable of interest. The mean total number of listed medications per patient was 10.96, with a standard deviation of 5.12 (median = 10, mode = 10, minimum = 0, maximum = 38). Over the duration of the study, the mean percent medications discrepant was 12.46% (standard deviation = 18.0%), with a median of 5.55 and a mode of zero. Percent of discrepant medications ranged from zero to 100. It appears that the discrepancy rate is relatively constant up to 25 medications. Thus, the percent of medications that are discrepant seems to be unrelated to the number of medications one is taking.

**Change in Medication Discrepancy**. Were the three clinics able to reduce the rate of medication discrepancy over time following the intervention? To examine this question, a Statistical Process Control (SPC) analysis was conducted for each clinic. The analysis first examines whether a process was in place, with a SPC analysis of whether the variability across the months following intervention was in control (2 sigma control limits). If the variability is out of control, there was no process in place, and it is not meaningful to see if the process was in control. If the process is found to be in place, it is then determined if it was in control and for how long by examining the mean percent medications discrepant by month using two sigma control limits. Results show that Clinic 1 developed and maintained a clear process until 10 months post intervention, at which time the variability exceeded the control limits. In Clinic 2, with the exception of month 9 after the intervention, the variability in percent medications discrepant was in control, and Clinic 2 did develop a process of medication reconciliation. In the intervention month for Clinic 2, the process was out of control, but there was a initial sharp decline in discrepant medications, and that decline continued steadily throughout the study period. Of the three clinics, Clinic 3 most definitively developed a process from month 1 onward and maintained that process in control for the same period.

When all clinic data were combined at baseline and compared versus at the 3-month post-intervention time, there is evidence that the accuracy of medication lists improved. At baseline, 20% of med lists examined had no discrepancies reported.

Three months after initiating the intervention, over 50% of the med lists had no discrepancies.

## Focus Group and Qualitative Findings.

The purpose of the focus group interviews was to qualitatively capture key learnings from the grant project. Outcomes include the following: 1) document key learnings from the first and second year; 2) identify barriers to success; 3) document how leadership views of this project may be integrated into future PeaceHealth endeavors; and 4) compare and contrast learnings between the first and second years of the project. Below are highlights from focus groups performed in September 2004 and June 2005 followed by a summary of the experience over the 2 years, as perceived by project and health system leadership.

### *Summary report from the September 2004 AHRQ Oversight Focus Group.*

- There was general agreement about the purpose of this project: to improve patient safety around medications by implementing and evaluating the effectiveness of a shared medication list.
- Some differences were expressed around the intention to develop a completely new tool for this project, versus using and improving the existing Shared Medication List (SML) from the Pursuing Perfection initiative.
- Challenges included the ambiguity and lack of clear direction inherent to an innovation and implementation project.
- Over the first year, there was a change in perception of how to reach the goal. Initially thought to be a technical solution, most came to realize the larger, more critical piece was the interpersonal communication between the clinic team and the patient.
- There was acknowledgement that there would be issues around accountability, culture, and communication at various levels, but all felt that the project was “very likely” to succeed.
- The recommendation to include the patient as well as the clinic team in team meetings and discussions on process improvement was felt to ensure success.

### *Summary report from the July 2005 AHRQ Oversight Focus Group.*

- The oversight committee felt this project had succeeded in advancing the cause of medication safety over the previous year.
- The Shared Medication List (SML) tool was valuable.
- Patient participation in the development of the tool and the process work has promoted a positive culture change in participating groups.
- Understanding that the electronic tool will not help all patients directly but is valuable to many caregivers of patients not able to use the tool.
- Realization that working with patients in a close, one-on-one relationship takes more time than originally anticipated, but taking the time is valuable.
- To provide a seamless experience to the patient and avoid confusion, there should be one tool rather than the several patient tools currently available.
- Understanding that “one size does not fit all” when it comes to the tool itself. Patient needs differ from the needs of healthcare professionals.

- Collaboration across regions and across teams to share learnings and best practices was identified as extremely valuable.

***Summary report from the two focus groups.***

- Transformation from fear of including patients on teams and in the process to finding this a crucial part of process improvement. Moving to full disclosure.
- Finding value in qualitative evaluation and interacting with the patient one-on-one, in large and small groups.
- Starting small with a prototype and including stakeholders in development; small steps of change.
- Stakeholder ownership in the process and development is critical.
- Building infrastructure to support the project and all participants including patients and staff is critical to success.
- There is still a need to address the use of multiple electronic tools in the health system – which should be the tool of choice or how could they work together.

**Healthcare Professional Observations.** Early discussions with providers and staff dealt with the definition of an “accurate” medication list; who was accountable to maintain the med list; and what meds, prescribed or non-prescribed, belonged on the med list. To many healthcare professionals, the accurate list was the one they documented in their EMR, identifying medications they prescribed. After much discussion, it was decided that the dictionary definition, “conforming exactly to fact; errorless” meant sticking to the fact of what the patient chose to take. *The focus needed to change from the healthcare professional to the patient*. It became clear, and consensus was obtained, that accountability for an accurate med list needed to be shared between the healthcare system and the patient. On the healthcare side, it was felt that the primary care physician or the “medical home” that the patient chose was accountable for maintaining the med list in the electronic medical record (EMR). Accepting this definition also meant the clinics had to find a way to deal with all of the non-prescribed medications taken by patients and figure out how to document them in an EMR that did not facilitate these additions. Another observation was that the EMR medication functionality was designed as a prescribing tool and that this did not necessarily support maintaining an accurate, continuity-based medication list that reflected what the patient was actually taking.

Staff and provider involvement in the process improvement of medication management within their clinic affected study outcomes. It was evident that having team members who were at the point of service and were participating in the study resulted in improved outcomes. Engagement was reduced the more that team membership was removed from the actual patient/provider interface. For example, in one clinic site, the team included the pilot provider, nurse, and two patients. At another site, where they had some experience with meds list reconciliation and did not have direct provider or patient participation, engagement of staff and providers was perceived to be lower.

Patient participation on the clinic pilot site quality improvement team introduced a new experience for providers, staff, **and** patients. Early in team development, concerns were raised about sharing internal process problems with patients on the team. There was fear that the patients would lose trust. When the patients were involved with the team, they revealed *that they knew there were internal process problems* and they were glad to be asked to help resolve issues. The patient trust level actually improved, and the team was comfortable with their engagement.

Healthcare professionals participating on the process improvement team gained understanding about what the staff is doing to acquire and document accurate information and create a seamless visit for the provider and patient. One participating physician reported that she "had no idea" about all the effort her nurse and receptionist were making outside of the exam room for each visit.

Assumptions made about the value of specialist interfaces were only partially valid. From the view of some PCPs, it *may be* valuable to have specialist medication information interfaced and viewable. From the specialist viewpoint (i.e., Cardiology), the value is less, because they see referred patients less frequently. From the patient perspective, it is of low value to them unless there is an interface with the particular groups in which there is frequent interaction with the patient. In other words, for patients, if we cannot interface with the VA or their "old doctor's" records in Georgia, it isn't so valuable to them. They want to choose the records to import.

**Patient Observations.** Patients made assumptions about the healthcare professional's full access to their information and about their lack of ability to communicate problems. Patient attitude about fully communicating with their healthcare professional was key to achieving an accurate meds list. Interviews revealed:

- Several patients reported surprise at how complex prescribing and maintaining an accurate med list can be, particularly when there are multiple providers in multiple care settings involved.
- During meetings and training sessions, patients revealed they thought "their doctor" knew exactly what they were taking from all providers across the community.
- Patients would often not tell their provider they were not taking a prescribed medication due to cost because they did not want to "disappoint" him/her.
- If they could not take a medication because it made them ill, they hesitated to tell the doctor, because they felt it was what the doctor "expected" them to take and they did not want the doctor to "yell" at them.

Patients also did not understand that, by talking to their doctor about problems with their medication, they might find an alternative that would work better for the patient. Once they were reassured that their healthcare professional wanted and needed to know this information, the interaction during the visit improved (according to patient feedback).

Patient engagement and retention in the study were dependent upon respect for their time, frequent communication, adequate training to use the SCP tool, availability of resources to support them, engagement of their healthcare professional in the project, and extent of reliance on medications (number of meds taken). Attrition for registered training sessions and meeting attendance was almost 50%. A higher degree of success was achieved when the patient received personal phone calls reminding them of meetings or training sessions, gaining commitment.

Caregivers of more frail and vulnerable participants found the Shared Care Plan to be valuable as an information resource. Children/relatives or close friends of patients who were assisting with the patient's care were especially grateful to have a repository of personal health information that was "portable." During an emergency, they had the information needed to communicate with the healthcare professionals providing care.

## Conclusions

This study demonstrated that it was possible to develop a medication list e-tool from multiple medication list data sources that can be accessible to patients, caregivers, and healthcare practices and that is "portable" for use wherever patients go. Additionally, the process of medication management in the ambulatory setting improved in this project through a collaborative effort between patients, clinical practices, web support staff, and the healthcare system. Each partner experienced a unique set of "key learnings."

**Patients.** Patient involvement in the quality improvement process and technical development of the tools was critical. This new relationship with the healthcare system led to clinical work practices that were more effective, efficient, and sustainable. Patients found the electronic medication list and Meds On Record functionality very beneficial and wanted to continue using it. They felt safer with being able to see their EMR med list alongside their own in the Meds On Record view, felt more confident that fewer medication errors would be made, and felt that the use of this tool by their providers improved communication. These tools also created many opportunities to educate patients about their meds by 1) reviewing and comparing their active meds to Meds on Record with their clinician; 2) researching their meds in a Healthwise medication information database that was linked to their med list; 3) taking an active role and accountability for maintaining their own med list; and 4) doing this in the context of the Personal Health Record (PHR), which allowed patients to see what effect (if any) the medications were having on them. Many patients measured the e-tools value by how much their participating clinician seemed to use it.

It is evident from this study that patients perceive that their providers and clinic know more about their medications and have more confidence in the accuracy of their med lists than what is actually true. This is evidenced by the high clinic patient satisfaction scores despite pilot clinic site med list discrepancy scores, indicating that about one-quarter to one-third of meds on the med list at baseline were inaccurate. Some patients don't fully understand the importance of maintaining an accurate med list, so there was surprise when study participants realized the complexity of maintaining an accurate med list through the view of the clinic staff. It is clear that patient engagement in the process was the only way to develop and maintain an accurate list. Patients will need to be educated and trained to maintain an accurate med list. This knowledge and the skill to effectively interact with the health system to maintain a med list, especially among those with complex regimens, will require focused training and attention to health literacy principles, something that is not common in our care system today.

There were some technical usability issues and fear of technology among patient participants. Many participants were older adults who had learned computer technology later in life; although they are more computer savvy than many, the concept of recording and monitoring medications electronically is a new concept to them. The print feature in the Shared Care Plan that could produce a wallet-sized list of the medications was a successful tool to assist those who preferred a paper record. It also appears that the Next Steps (patient goals) and Advance Directive functionalities developed in this study proved valuable to patients and providers. As younger adults age, the technical skills will likely improve, and these tools will be more acceptable.

**Healthcare Clinics.** There were two major improvements that occurred in the healthcare clinic setting as a result of this study: the clinic medication safety culture increased, and the accuracy of the medication lists in the EMR improved. The assumption, of course, is that, as both of those indicators improve, so does the safety of patients receiving care in those settings. The PeaceHealth Ambulatory Medication Safety Culture Survey has strong psychometric properties and was an effective tool to provide feedback to clinic staff regarding the perception of medication safety in their work environment. An important and effective intervention was the discussion amongst clinic staff about how they could make their clinic safer as part of the survey feedback.

Redesigning the process by which meds are managed in the clinic practice workflow led to more accurate med lists. Staff and providers were highly motivated to raise the awareness of med safety and design more reliable processes to ensure accurate medication lists. Five key process components were developed to guide medication management at every significant ambulatory clinic encounter: 1) all patients will be asked to provide a current list of meds, including OTCs, nutraceuticals, and herbals; 2) clinic personnel will review the meds with the patient at the beginning of the office visit; 3) the patient’s med list and EMR med list will be reconciled and documented; 4) any new prescribed meds will be checked for interactions/conflicts with an updated, reconciled med list in the EMR; and 5) the patient will be offered a paper copy of an updated, reconciled med list at the end of the visit.

In one clinic, accuracy of med lists improved through the process redesign, but the culture of med safety did not. This raises the issue of whether the two necessarily go hand-in-hand. Follow-up will be needed in that clinic to see if the new workflow processes will be reliable and sustainable, as it is hypothesized that the clinic culture will impact the sustainability of work processes. It may also be that the culture of safety in that particular clinic will require more than the 6-month period used in the study.

Some clinicians found that the reconciliation of medication discrepancies was faster with the e-tools, and this finding created more confidence that they actually knew what meds patients were taking. Clinicians reported that there were more discussions about non-prescribed meds and that they were better able to assess how well patients understood their meds. Overall, clinicians felt this improved communication with patients. Alternatively, there was a realization that a standardized, reliable medication management office workflow process will require more time by staff and providers. Obviously, this may be a barrier for many clinicians to adopt these new processes. Studies that demonstrate the downstream benefits and potential cost and time savings with safer medication management practices will be needed in the future.

**Healthcare System**. This project received considerable support, both financially and through advocacy, from the highest levels of leadership in PeaceHealth. The mission and values of the organization were clearly supported. There was a strong belief that safer medication practices in the ambulatory setting will lead to fewer errors and adverse events in the clinic, Emergency Dept (ED), and hospital. Anecdotally, it was reported that more accurate medication lists reduced time spent in reconciliation on the ED and inpatient wards and that clinicians were able to make better clinical decisions.

Patient involvement, both in participating in quality improvement projects and in engaging patients to be more actively involved in managing their med lists, was a key feature that became more ingrained in the culture of the organization. Initially promoted in the RWJF Pursuing Perfection project, this study allowed the continued exploration and dissemination of patient involvement strategies across other regions in the organization. This level of involvement is now an expectation of all quality improvement projects across all regions in PeaceHealth.

For over a decade, PeaceHealth has had a mission to develop an electronic community health record that would be accessible to all those caregivers who needed to have access to the medical record. This project has added another piece to that endeavor and expanded an understanding of the technology and work processes necessary to implement such a record in the community. A combination of the personal health record functionality found in the Shared Care Plan and PeaceHealth's EMR patient application, PatientConnection, is the base concept of a new project to develop a patient portal. The portal work began during the third (extension) year of the AHRQ grant and will provide thousands of patients and caregivers with an anytime/anyplace web-based tool to facilitate active communication of accurate, specific information and patient requests or concerns. The new portal will be offered to all 1.5 million PeaceHealth patients in Oregon, Washington, and Alaska.

This study confirmed the importance of user-centered design methodology in development of electronic tools to support care rather than the alternative, developing the tools and then making them work in existing practice workflow. Access to and relationships with clinic staff and patients led to a more user-friendly tool that is more likely to be used and sustainable over time. Technical staff confirmed that a web service approach is preferable to databases, interface building even with the three different med list data sources was resource intensive, and that data from EMRs and prescribing software does not necessarily lend itself well to an effective and efficient medication management process. A Shared Care Plan CD and Developers Manual has been created at no cost for those health systems and entities interested in implementing these tools (see Products section).

Work accomplished in this project has helped inform and promote implementation of a medication reconciliation and management process that is now occurring in all medical groups across all five regions of PeaceHealth in Oregon, Washington, and Alaska. In the past year, this project joined forces with the IHI Saving 100K Lives Campaign at the direction of our executive leadership, who felt that medication reconciliation needed to occur across all care settings, not just in the inpatient arena. Addressing medication management across the continuum of care has no doubt led to safer care of our patients across the community. Also, this has clearly affected the culture in a positive way across the organization. It continues to be a challenge to work with non-affiliated medical practice groups, specialty groups, pharmacies, long-term care facilities, and others who do not share the same culture or have competing priorities.

## Future Implications

This project was an extension of innovation work and testing using “small tests of change” methodology. Throughout the implementation of this project, innovation and discovery work continued to reveal important lessons about engaging patients; ambulatory medication and management processes; and the electronic tools necessary to support those processes, patients, and healthcare practices. The next step is to implement, further innovate, and test these tools and processes at a larger scale, such as across an entire community or healthcare system.

Does a shared electronic med list reduce med errors and adverse drug events? Although it appears that med list accuracy and practice culture improves, it is not clear that primary clinical outcomes are affected by this intervention. Only through additional research, preferably one that randomly assigns patients or practices of care, with a much larger population followed longitudinally, will this question be answered. Also of interest would be whether some patient populations, such as those with more complex medication regimens or with multiple or specific chronic conditions, would receive more benefit in terms of reducing their risk of adverse events by participating in this model of care.

There were a number of technical development learnings that will help inform the development of regional health information networks. Although these occurred on a much smaller scale, many of the issues, barriers, and successes experienced in this project will likely be repeated as regional networks are developed. This will be particularly true as interfaces are built across disparate electronic systems, new technologies and vendors emerge, public-private relationships are formed, and implementation occurs in systems of care that have different cultures and agendas.

Creating medication management processes and improving the culture of medication safety in the ambulatory care setting will be critical to improving patient safety. This study has explored, tested, and developed reliable, standardized processes and a tool to measure safety culture that other ambulatory clinics can replicate. These processes and tools can be implemented whether electronic tools are available or not. Additional dissemination of these findings would be beneficial.

## PUBLICATIONS, PRESENTATIONS

Stock RD. Making Healthcare Safer: The PeaceHealth Community-Wide Shared Medication List. AHRQ staff weekly conference, Washington, DC, March 2005.

Stock RD. Engaging Facilities, Patients and Caregivers: Developing Technology Systems to Support the Continuum of Care. Presentation for HealthTech Conference, Healthcare Environments of the Future: The Future of Geriatric Care, San Francisco, CA, September 2005.

Gauthier D and Stock RD. PHRs and EMRs: Sharing Data and Functionality Between Patients and Healthcare Professionals to Improve Safety. AHRQ Patient Safety and Health IT Conference, Washington, DC, June 2006.

Stock RD and Mahoney E. The PeaceHealth Ambulatory Medication Safety Culture Survey. AHRQ Patient Safety and Health IT Conference, Washington, DC, June 2006.

Mahoney E. Staff Engagement and a Culture of Safety. AHRQ Patient Safety and Health IT Conference, Washington, DC, June 2006.

## PRODUCTS

Mahoney E and Stock R. The PeaceHealth Ambulatory Medication Safety Culture Survey. PeaceHealth, 2004. Contact author for more information at rstock@peacehealth.org.

Mahoney E. The Patient Experience with Med List Survey. PeaceHealth, 2005. Contact author for more information at rstock@peacehealth.org.

Stock R and Mahoney E. The Medication List Discrepancy Tool. PeaceHealth, 2003. Contact author for more information at rstock@peacehealth.org.

Shared Care Plan Application and Documentation Version 1.0 CD, PeaceHealth, 2006. http://www.peacehealth.org/System/News/SharedCarePlan061306.htm