Developing a Community-Wide Electronic Shared Medication List

Ron Stock, MD; Eldon R. Mahoney, PhD; Dawn Gauthier, MIS; Linda Center;
Mary Minniti, CPHQ; James Scott, MD; Marc Pierson, MD; Lori Nichols

Abstract

This study demonstrates the feasibility of developing a medication list e-tool from multiple medication data sources that is accessible to patients, caregivers, and health care practices and is "portable" or accessible wherever patients go. A single medication list was created electronically by integrating data from the Shared Care Plan, a Web-based personal health record, and clinic electronic medical records (EMRs) to create a single, Web-based view. The feasibility of sharing accurate, updated information with everyone involved in a patient's care was explored using innovative technology and training, while motivating health care professionals and patients to communicate medication regimen changes. Qualitative and quantitative evaluation methodologies were utilized to assess the impact of interventions among three outpatient clinic sites and 108 adult patients. Through extensive collaboration, clinic sites improved the accuracy of patient EMR medication lists, medication safety culture improved, and patients found the electronic medication list beneficial.

Introduction

Thousands of deaths and injuries occur annually in hospitals due to preventable medical errors, and preventable drug reactions are a leading cause of these errors.[1] An Institute of Medicine (IOM) report[2] suggests that medication errors leading to adverse drug events (ADEs) are as frequent or more frequent in the ambulatory setting. According to the report, a key approach to developing and maintaining a safe medication management system is to establish a strong clinician-patient relationship, improve patient medication self-management and availability of information, develop a culture of medication safety in the health care setting, and use health information technology to improve medication management. Only through engagement of multiple stakeholders in the medication management process will medication safety improve.

Despite the fact that medication prescribing is the most frequently used therapeutic intervention and that nearly two-thirds of office visits end with a prescription, relatively little is known about the ADEs that occur in the ambulatory clinic setting.[3] ADEs occur frequently in the outpatient clinical setting, and as many as a quarter of them are preventable.[4, 5] A recent survey using an ICD-9-CM code methodology[6] found that during the period 1995-2001, 2.5 to 3.7 per 1,000 physician office visits and 1.8 to 3.4 per 1,000 hospital outpatient visits involved ADEs.

In the outpatient setting, medication errors and subsequent ADEs can result from physician/ provider-related, health system/practice process-related, or patient-related factors or a

combination of these factors. To understand these factors, it is important to examine the processes involved in each of these three domains. Although little is known about the processes and/or risks in all domains, probably the least known are patient-related processes and risks from the patients' perspective.

From the ambulatory practice perspective, it is assumed that management of an accurate medication list would result in fewer medication errors and, therefore, fewer ADEs 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 a patient is taking. Lack of access to accurate information presents a serious gap that prevents providers from delivering optimal health care services and increases the risk of medical errors. Another challenge is to implement reliable medication safety practices in every outpatient clinical setting and across the care continuum. Discrepancies between medications recorded in clinical office files and patient-reported medications are common and involve all classes of medications, prescribed and over the counter. These discrepancies present a particular risk to older patients who are taking multiple medications.[7]

This project was based on the premise that creating an accurate medication list and making it available to patients and caregivers at each encounter within the broader health care system would enhance medication safety. We hypothesized that patient engagement is a critical component for maintaining an accurate medication list. Effective interactions between the health care system and patients, especially those on complex medication regimens, are uncommon in today's health care environment. The challenge is to implement reliable medication safety practices in every outpatient setting, with involvement of patients and all their caregivers across the care continuum.

Methods

The project's goals were accomplished through three objectives, to:

1. Develop a single, updated, and reconciled medication list and care plan that would be electronically and manually accessible to patients and their caregivers, physicians, alternative care practitioners, clinics, hospitals, home health aides, nursing homes, and others who participate in the care of each patient.

2. Develop a medication reconciliation process that involves the patient, clinic, and other health care providers or care settings.

3. Measure perceptions of patients and clinicians regarding 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 to analyze the impact of the process on culture change.

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

Participants

PeaceHealth is a nonprofit, integrated health care system that operates hospitals and clinics in Washington, Oregon, and Alaska. In 1990, the PeaceHealth leadership set out to develop a sophisticated information management system that would support a standardized electronic medical record that was shared by each of its health care facilities. Over the past decade, PeaceHealth has developed new tools and software programs that can provide medical information accurately and efficiently.

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

Based on their interest in improving medication safety and experience in quality improvement projects, three ambulatory care clinics were chosen to participate in this project:

1. Senior Health and Wellness Center (SHWC), in Eugene, OR, with four geriatrician providers and two nurse practitioners.
2. Center for Senior Health (CSH), in Bellingham, WA, with seven adult medicine and geriatrician providers.
3. Health Associates at Peace Harbor (HAPH), in Florence, OR, with 13 adult care providers.

A medication safety quality improvement team—involving providers, nurses, administration, pharmacy, and patients—was formed at each pilot site. Adult patients were recruited from all practice sites to test the SCP and electronic medication management processes.

The Single, Updated, and Reconciled Electronic Medication List

The clinic medication process-mapping phase and technical development of tools occurred simultaneously. Technical design questions included:

1. How can technology support the medication reconciliation process?
2. How can existing medication data be shared?
3. How can PeaceHealth build on what has already been learned from existing electronic tools?

To answer these questions, a user-centered design methodology[8] was employed, in which the tasks, needs, wants, and limitations of the end users within each system were given attention at each stage of the design process. From as many source systems as possible, including the patient, the intent was to collect information on one page that would allow health care professionals to better identify and document within their systems exactly which medications each patient was taking.

Initially, a shared medication list functionality was developed within the SCP that provided medication information from the provider-managed electronic medical record (EMR) and the

patient's documentation via a single Web page. This Web page, called "Meds On Record" (MOR), was available within the SCP medication list function. Because of the recognized value in showing allergies and intolerances when prescribing medications, that information was also made available through the MOR. The medication list included both prescribed and nonprescribed medications. This project also developed functionalities within the SCP for patients to document their personal health goals and to store electronic copies of their advance directive.

"Meds On Record" Functionality

With patients entering medication data into their SCPs and health care professionals entering medication data into their EMRs, it was possible to build interfaces to the participating systems in order to create the Meds On Record view (Figure 1).

The participating health care entities and their respective clinical systems included:

- PeaceHealth, using GE/IDX LastWord.

- Oregon Cardiology, using AllScripts™ Medications.

- Three independent clinics in Whatcom County, Bellingham, WA, piloting Dr First[SM] 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

Figure 1. "Meds On Record" functionality diagram.

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 of 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 SCP, LastWord, and AllScripts. RCopia used demographic data from the SCP to match patients in its system and then store the patients' unique SCP IDs in the RCopia system.
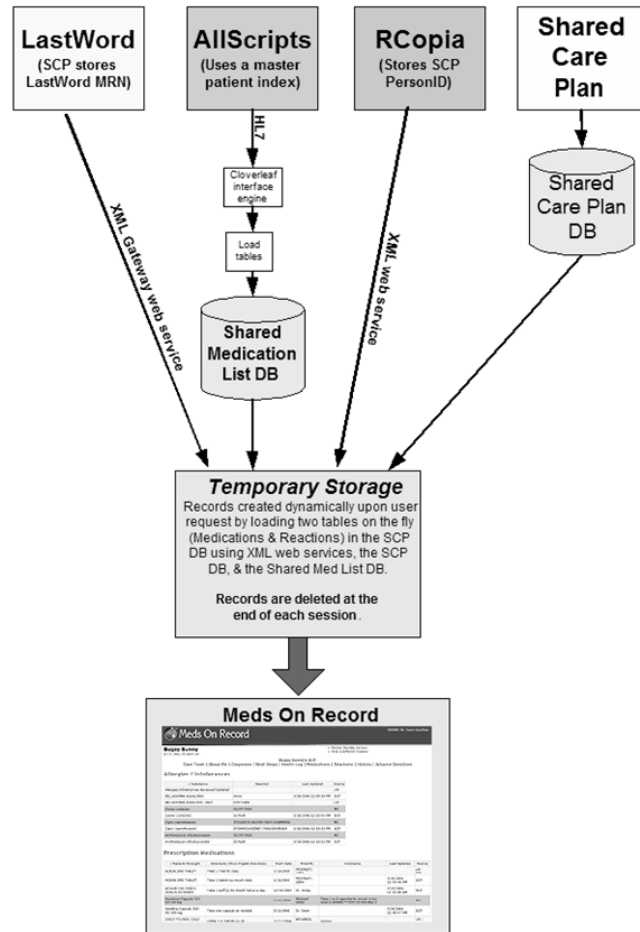
Patients accessed Meds On Record through their SCPs, while health care professionals accessed it from a Web link within their clinical systems. In the LastWord (EMR) system, health care professionals received notification by a pop-up alert whenever they activated the record of a patient who was participating 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.

The Ambulatory Medication Reconciliation Process

The three clinic pilot teams mapped current medication reconciliation processes at the beginning of the study, 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 HAPH group had been working on medication list reconciliation for 2 years, thus requiring integration into an already re-engineered medication process. The CSH was undergoing reorganization and a physical site move early in the study but by early summer 2005, was fully participating in process redesign.

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

Project Evaluation

The following quantitative and qualitative measures were utilized to evaluate the impact of interventions used in this project:

Ambulatory medication safety culture survey. An ambulatory-focused survey[9] measuring the degree to which a culture of medication safety was present in a clinic was developed using components from previously studied safety culture surveys, which were primarily hospital-based.[10, 11, 12] Baseline data from office staff were collected for the three clinics prior to intervention (June 2004 for two clinics, August 2004 for the third). A followup survey for all three clinics was carried out in June 2005.

Patient experience with the shared medication list (PESML) survey. Each clinic was asked to recruit 35 patients over the age of 18 as active participants in process improvement and design. After PeaceHealth System IRB approval, patients were identified and recruited to participate, and participant informed consent was obtained. Patients were registered into the SCP and trained in the use of the tool. A 19-question telephone survey (PESML) was conducted 60 days after patients signed up for the SCP to solicit information about their experiences using the shared medication list and SCP.[13]

Patient satisfaction survey. PeaceHealth regularly conducts patient satisfaction surveys with a probability sample of patients following an office visit. Two questions were added for patients from the participating clinics to evaluate their perceptions of medication safety in those clinics. These two questions were: (1) "I am confident that my primary provider knows all of the medications I am currently taking"; and (2) "I am confident that all of my health care providers other than my primary doctor know all of the medications I am currently taking."

Medication list discrepancy measure. The aim of this outcome was to measure the degree to which the medications a patient is taking are known by the primary care physician or practice where the patient receives care. A tool was developed to measure the extent of medication discrepancies between what the patient was taking and what was documented in the medical record. Using a standardized tool and process,[14] a sample of 15 to 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. One clinic (Clinic B) chose to obtain discrepancy data from all patients coming for an ambulatory visit during the post-intervention period. A percent of medication discrepancies was calculated for each patient by dividing the number of meds the patient was taking that were not on the med list, or the number of meds the patient was not taking that were still on the med list (discrepancies), by the total number of medications that would accurately reflect the patient's medication list.

Focus group and observational review. An experienced outside consultant was hired to query the Agency for Healthcare research and Quality (AHRQ) Leadership Oversight Group and document the leadership team's perceptions of this project and change as a result of the project. This group included the regional executive sponsors and 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, health care professionals, clinic staff, and technical support staff were recorded throughout the study.

Results

Ambulatory Medication Safety Culture Survey

Staff, including physicians from all three pilot clinic sites, completed an online PeaceHealth Ambulatory Medication Safety Culture Survey[9] pre- and post-intervention. The total number of clinic staff completing the survey in the first administration was 62 (response rate = 60 percent; Clinic A: N = 20; Clinic B: N = 16; Clinic C: N = 26). In a second administration 12 months after the intervention, the total number of staff survey completions was 80 (response rate = 77 percent; Clinic A: N = 20; Clinic B: N = 28; Clinic C: N = 32). The 16-item survey showed good internal consistency reliability with minimal ceiling and floor effects. Cronbach alpha was 0.94 and 0.90, respectively, for the two administrations. The internal consistency reliability was maintained in all clinic sites (Clinic A = 0.96; Clinic B = 0.90; Clinic C = 0.94).

Item difficulty. Item difficulty is the degree to which a survey item is easy or hard to agree to. In this survey, the difficulty of the items has a hierarchical structure, since to have measurement of a culture of medication safety, there must be a sufficient range of item difficulties. Since the item difficulties indicate how difficult it is to put each item's referenced component in place in

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building a culture of medication safety, information can be provided in terms of the developmental progress in building such a culture in the clinic environment. The most difficult item for staff to endorse was, "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 of the staff felt a need for defined protocols for reporting and discussing medication mistakes. Approximately 20 percent of the staff would be concerned if a member of their family were a patient there due to concerns about possible medication errors.

Clinic differences and change over time. To evaluate differences among the three clinics and change over time in the culture of medication safety, a univariate general linear model analysis was conducted on survey scores. Clinic and year (2004, 2005) were fixed factors with no covariates. There was a significant between subject's effect for clinic (F = 9.65, P <0.0001) and year (F = 17.5, P <0.0001) and a significant clinic-by-year interaction (F = 14.28, P <0.0001). The nature of the interaction was that Clinic A and Clinic B significantly improved in culture of medication safety from 2004 to 2005, while there was no significant change in Clinic C (95 percent CI). At baseline in 2004, there were no significant differences among the three clinics, but in 2005, Clinics A and B had a significantly higher culture of medication safety score than Clinic C (95 percent CI).

Patient Experience with the Shared Medication List (PESML) Survey

To assess patients' experience with the SCP medication list, 104 patients (Clinic A, N = 38; Clinic B, N = 34; Clinic C, N = 34) were recruited from the three pilot clinics. Of all consenting participants, 59 percent accessed their SCP within 60 days of signing up for participation (N = 61): Clinic A, N = 26; Clinic B, N = 18; Clinic C, N = 17). A completed telephone survey was obtained from 51 participants (response rate = 84 percent; Clinic A, N = 26; Clinic B, N = 10; Clinic C, N = 15). Only patients who had accessed their SCP were contacted for the telephone survey. Table 1 summarizes the telephone survey responses.

Patient Satisfaction Survey

Using a patient satisfaction telephone survey, 486 patients receiving care in the three pilot clinics answered two questions about their perception of providers' knowledge of the medications they were currently taking. Overall, 95.8 percent 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"; 62.1 percent of patients strongly agreed with this statement. Although lower than for the primary care provider, 92.6 percent of patients agreed or strongly agreed to, "I am confident that all of my health care providers other than my primary doctor know all of the medications I am currently taking"; 45.6 percent of patient responders strongly agreed with this statement. These rates of confidence did not differ significantly by clinic. Answers to these two confidence questions were not related to the patient's age or sex. 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).

Table 1. Summary of patient experience with shared medication list (PESML) telephone survey results

- A majority (61 percent) of patients reported going online to look at their medication list.
- A large majority of patients found the SCP easy to access and the medication list easy to use, to read (100 percent), and to print (94 percent).
- 96 percent of patients thought the medication list contained all the information they needed to understand what medications they were taking, when to take them, and how to take them.
- Patients were more likely to take a printed copy of the medication list to providers other than their primary care physician.
- An equal number of patients never took a printed copy of their medication list to a primary care physician visit or always took a printed copy to a primary physician.
- A majority (78 percent) of patients said that having a medication list made them confident that wherever they went for health care, the providers would know which medications they were taking, and they would not be given a medication they should avoid.
- Most patients said they would indicate on the medication list whether they were not taking a prescribed medication (92 percent) and would report herbals and other over-the-counter supplements (97 percent).
- A majority of patients felt that having a medication list made them more confident they were taking their medications correctly (78 percent), and they felt their primary care physician knew which medications they were taking (86 percent).
- 97 percent of patients said that having their medication list made it easier for them to take an active role in their health care.
- 90 percent of patients said that having a medication list improved the communication between themselves and their health care providers.
- 83 percent of patients said that having a medication list made them more aware of the possibility of medication errors; the same percentage said it reduced their fear that a medication mistake would be made.

Medication List Discrepancy Measure

It was hypothesized that the number (percent) of medication discrepancies between the practice medical record and what the patient is actually taking would decrease following the intervention. Using a standardized tool and process,[14] a sample of 15 to 30 patients at each of the three clinics was randomly selected at baseline (pre-intervention), and a new sample was chosen monthly at two clinics to measure the percentage of medication discrepancies over time. The third clinic (Clinic B) acquired discrepancy data from most patients daily during a 5-month postintervention study period. From the three primary care clinics, 903 patients provided medication use data (Clinic A, N = 178; Clinic B, N = 614; Clinic C, N = 111).

Change in medication discrepancy. To examine whether the clinics reduced medication list discrepancies over time, a statistical process control analysis was conducted for each clinic. The analysis first examined whether a process was in place, with a statistical process control analysis assessing whether the variability across the months following intervention was in control (2-sigma control limits). If the variability was out of control, there was no process in place, and it was not meaningful to see if the process was in control.

If the process was found to be in place, it was then determined whether it was in control and for how long by examining the mean percent medications discrepant by month using 2-sigma control limits. Clinic A developed and maintained a clear process until 10 months post-intervention, at which time the variability exceeded the control limits. In Clinic C, with the exception of months 9 and 10 post-intervention, the variability in percent medications discrepant was within control, and Clinic C did develop a process of medication reconciliation. Month 9 was characterized by excessive variability, which was followed by a sharp decline in process variability in month 10. In the pre-intervention month for Clinic C, the process was out of control, but there was an initial sharp decline in discrepant medications, and that decline continued steadily throughout the study period. Of the three clinics, Clinic B most definitively developed a process from month 1 onward and maintained that process in control for the same period. Figure 2 shows that all three clinics developed a process and reduced the percentage of medication discrepancies over the postintervention period.

Comparison of data at baseline and 3 months post-intervention. When all clinic data were combined at baseline and compared to 3 months post-intervention, the evidence indicated that the accuracy of medication lists improved. At baseline, 20 percent of medication lists examined in the three clinics reported no discrepancies (i.e., the patients' medication lists were the same as those listed in the office medical record). Three months after initiating the intervention, over 50 percent of the medication lists had no discrepancies, and the number of very large discrepancies declined considerably (Figure 3).

Focus Group and Qualitative Findings

Leadership oversight focus groups. The purpose of the focus group interviews was to qualitatively capture key lessons from the project. Key findings from the focus groups, as perceived by project and health system leadership include:

- Although leadership initially thought improvement in medication list accuracy required a technical solution, most came to realize the larger, more critical piece was the interpersonal communication between the clinic team, patient, and IT technicians.
- The importance of issues related to accountability, culture, and communication at various levels of staff involvement from providers to nurses to receptionists was acknowledged.
- The recommendation to include patients in team meetings and discussions on process improvement was believed to assure success.
- Patient participation in the development of the tool and the process work promoted a positive culture change in participating clinical practice groups.
- Patient electronic medication list functionality needs differ from the needs of health care professionals.

In summary, leadership observed that an organizational transformation occurred from fear of including patients on quality improvement teams to full participation and transparency of clinical challenges and processes. Much was learned about the key components to successful quality improvement, such as building infrastructure to support all participants, including patients and staff, stakeholder ownership and engagement in the process and development, utilizing small steps of process change, and finding value in continuous feedback from patients and staff.
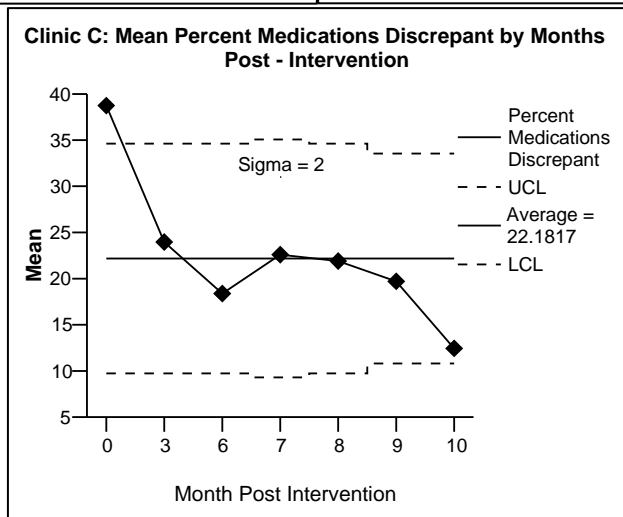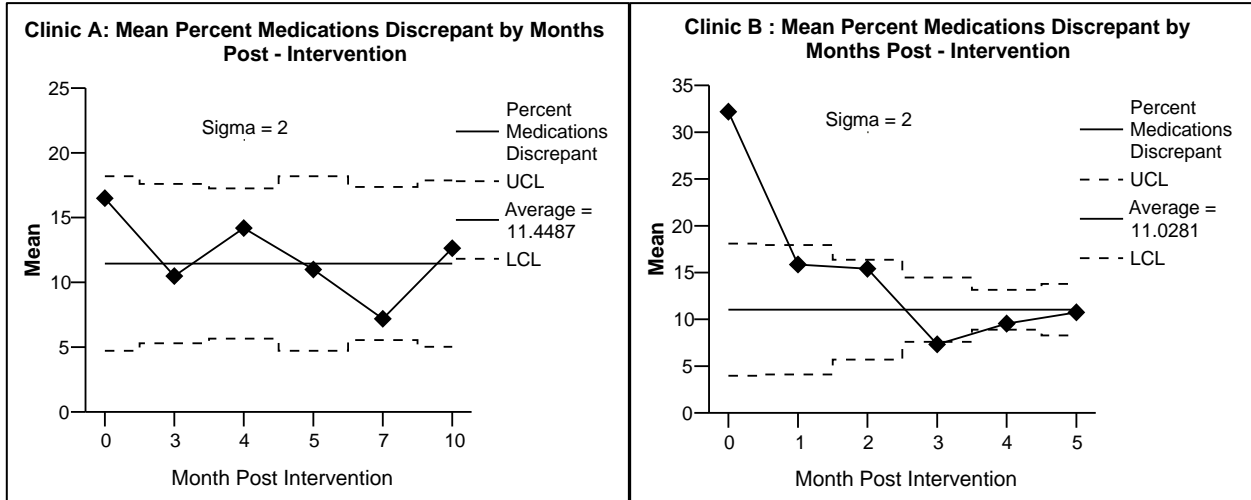
Figure 2. Postintervention mean percent medication discrepancies by clinic.
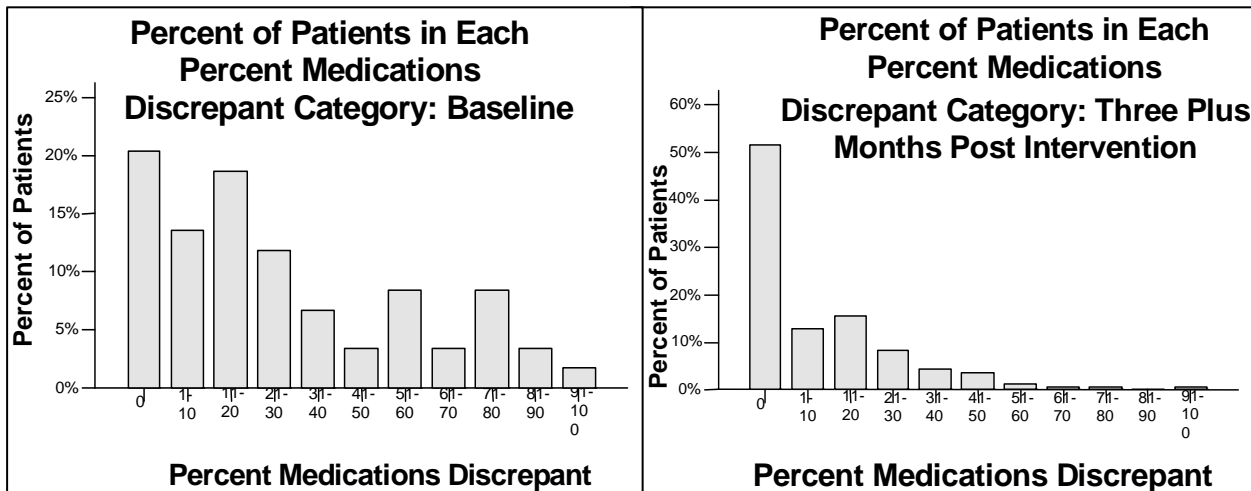

Figure 3. Baseline and postintervention medications discrepancy percentage for all participants.

Finally, there is still a need to address the use of multiple electronic tools in the health care system, to identify the tool(s) of choice, and/or to determine how they should work together.

Health care professional observations. Early discussions with providers and staff dealt with the definition of an "accurate" medication list, who would be accountable for maintaining the medication list, and which medications—prescribed or nonprescribed—belonged on the list. To many health care professionals, the accurate list was the one they documented in the EMR, which identified the medications they had prescribed. After much discussion, it was concluded that the dictionary definition of "accurate"—"conforming exactly to fact; errorless"—meant that knowing which medications patients chose to take was a critical component.

A consensus was reached that accountability for an accurate medication list needed to be shared between the health care system and the patient. It was agreed that the primary care physician or the "medical home" chosen by the patient was responsible for maintaining the EMR medication list. In addition, a need was identified to update EMR medication functionality. The EMR had been designed as a prescribing tool, but it does not easily support maintaining an accurate, continuity-based medication list that reflects which medications patients are actually taking.

It was evident that having team members who were participating in the study at the point of service led to improved outcomes. Engagement declined as team membership was removed from the actual patient/provider interface. For example, in one clinic the team included the pilot provider, a nurse, and two patients. At another site, where they did not have direct provider or patient participation, staff and provider engagement was perceived to be lower.

Patient participation on the clinic team was a new experience for everyone involved. Early on, concerns were raised about sharing internal process problems with patients. Qualitative feedback from some participating clinicians revealed a fear that patients might lose trust if they were aware of the challenges and complexity of our medication processes. However, patients involved with the team reported that they knew there were internal process problems, and they were glad to be asked to help resolve them. The patient trust level actually improved, and the team became comfortable with patient engagement.

Patient observations. Patients made assumptions about provider access to their information and about their ability to communicate problems. Patients' attitudes about communicating with their health care professionals were key to achieving an accurate medication list. Interviews revealed:

- Several patients were surprised at how complex prescribing and maintaining an accurate medication list could be, particularly when multiple providers in multiple care settings were involved.
- Most patients thought their doctor knew exactly which medications they were taking, regardless of whom in the community might have prescribed them.
- Patients often did not tell their doctor that they were not taking a prescribed medication due to its cost or because it made them ill. These patients were either afraid of "disappointing" the doctor or having the doctor "yell" at them.

Caregivers of more frail and vulnerable participants found the SCP to be a valuable information resource. Relatives or close friends assisting with patients' care were especially grateful to have a portable repository of personal health information. During an emergency, the SCP provided

them with the information they needed to communicate with the health care professionals providing care.

Discussion

The process of medication management in the ambulatory care setting was improved through a collaborative effort among patients, clinical practices, information technology support staff, and the health care system. Each partner experienced a unique set of "key lessons."

Patients

Patient involvement in the quality improvement process and technical development of tools was critical. This new relationship with health care providers led to clinical work practices that were more effective, efficient, and sustainable. Patients found the electronic medication list to be beneficial and desirable. The ability to see their EMR medication list alongside their own SCP list in the "Meds On Record" view made them feel safer and more confident that fewer medication errors would be made. Patients also felt the use of this tool improved communications with their providers. Tools such as the Healthwise® medication information software program, which was linked to the electronic medication list, created new opportunities for educating patients about their medications. Many patients assessed the value of the e-tools according to their perception of how much their participating clinician used it.

Patients perceive that their providers know more about their medications and have more confidence in the accuracy of their medication lists than is actually true. This was evidenced at baseline by high patient satisfaction scores despite a high degree of clinic site medication list discrepancy scores. Some patients do not fully understand the importance of maintaining an accurate medication list, and so, there was surprise when study participants realized its complexity. Patient engagement in the process is the only way to develop and maintain an accurate medication list. However, patients need to be educated and trained to maintain such an accurate list. This knowledge and the skill to effectively interact with the health care system will require focused attention to health literacy principles, something that is not commonly addressed in our health care system today. This is especially important for patients with complex medication regimens.

Only 59 percent of patients who signed up for the SCP in this study actually accessed their SCP within the first 60 days after signing up. Although this finding was somewhat low, there could be a number of explanations. For example, once patients' information was documented in the SCP, they might not have felt a need to access their data unless there was a change in meds or care plan. Many of the patients in this study were relatively healthy and functional, and so, changes to their care plan were probably infrequent and therefore presented no need to access their SCP. It has been observed subsequently that patients tended to access their SCP immediately prior to a health care encounter. So if these encounters were infrequent, then their access to the SCP would also be infrequent.

Patients might also be unaccustomed to accessing an electronic tool to maintain or share their medical information. Although most participants were comfortable using a computer, interacting with the health care system using this tool was new to them and would likely have required

training. Patients reported that they were likely to use the tool if they knew their health care provider was also looking at their information or engaged with the patient to use the information in their SCP. It could be that patients who perceived that their provider was not using or looking at their information might lead them to use the tool less often. Clearly, a more longitudinal evaluation of the SCP would provide meaningful information about usage of the tool.

There were some technical usability issues and fear of technology among patient participants. Many older adult participants were intimidated by the concept of recording and monitoring medications electronically. The SCP print feature, which produces a wallet-sized list of medications, was a successful tool for patients who preferred a paper record. As younger adults age, technical skills likely will improve, and these tools will be more acceptable.

Health Care Clinics

Two major improvements occurred in the clinic setting: (1) the clinic medication safety culture increased, and (2) the accuracy of the medication lists in the EMR improved. The Ambulatory Medication Safety Culture Survey proved to be an effective tool for providing feedback to clinic staff regarding the perception of medication safety in their work environment. Discussion among clinic staff about how they could make their clinic safer was an effective intervention.

Redesigning the process by which medications are managed in the clinic practice workflow led to more accurate medication lists. Staff and providers were highly motivated to raise the awareness of medication safety and to design more reliable processes to ensure accurate medication lists. Five key process components were developed to guide medication management at every ambulatory clinic encounter:

1. All patients are asked to provide a current list of their medications.
2. Clinic personnel review the list with the patient at the beginning of the office visit.
3. The patient's medication list and EMR medication list are reconciled and documented.
4. Any new prescribed medications are checked for interactions/conflicts with an updated, reconciled medication list in the EMR.
5. The patient is offered a paper copy of an updated, reconciled medication list at the end of the visit.

In one clinic, accuracy of medication lists improved through the process redesign, but the culture of medication safety did not. This raises the issue of whether improving care processes leads to improved safety culture or vice versa. It could be that providers and staff are good at making and following workflow process decisions regardless of the cultural context. Followup will be needed in that clinic to see whether the new workflow processes are sustained, since it is hypothesized that clinic culture might affect work process sustainability. It is also possible that improvement in the culture of safety at that particular clinic would require more than the 12-month period used in this study.

Some clinicians found that medication discrepancies could be reconciled faster using the e-tools, creating more confidence about knowing which medications patients were taking. Clinicians reported more discussions with patients about nonprescribed medications and an improved ability to assess how well patients understood their medications. Overall, clinicians felt this improved communication with patients.

Alternatively, there was a realization that a standardized, reliable medication management office workflow process requires more staff and provider time, which could be a barrier for many clinicians. Studies that demonstrate the downstream benefits and potential cost and time savings with safer medication management practices will be needed in the future.

Health Care System

This project received considerable support, both financially and through advocacy, from the highest levels of PeaceHealth leadership. There was a strong belief that safer medication practices in the ambulatory setting would lead to fewer errors and adverse events in the clinic, emergency department (ED), and hospital. Anecdotally, it was reported that more accurate medication lists reduced time spent in reconciliation within the ED and inpatient units, allowing clinicians to make expedient clinical decisions.

Patient involvement, both in participating in quality improvement projects and in engaging patients to be more actively involved in managing their medication lists, was a key feature that became more ingrained in the organizational culture. This study allowed further 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 in PeaceHealth.

The study confirmed the importance of user-centered design methodology in the development of electronic tools to support care, rather than the alternative of developing the tools and then making them work in existing practice workflow. Access to, and relationships with, clinic staff and patients led to a 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 with the three different data sources was resource-intensive, and data from prescribing software does not necessarily lend itself to an effective and efficient medication management process. A free Shared Care Plan CD and Developers Manual have been created for health care systems and entities interested in implementing these tools.[15]

Conclusion

This project demonstrated that it is possible to develop a medication list e-tool from multiple medication list data sources that is accessible to patients, caregivers, and health care practices and is "portable" for use wherever patients go. The process of medication management in the ambulatory setting improved through collaboration among patients, clinical practices, Web support staff, and the health care system. For over a decade, PeaceHealth has had a mission of developing an electronic community health record that would be accessible to all caregivers needing access to these data. This project 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. As a combination of the personal health record functionality found in the SCP and an EMR patient application, PatientConnection is the base concept of a new project to develop a patient portal. The portal work would provide patients and caregivers with an anytime/anyplace Web-based tool to facilitate active communication of accurate, specific information and patient requests or concerns.

Many of the issues, barriers, and successes experienced in this project will likely be repeated as regional health care information networks are developed. This will be particularly true as interfaces are built across disparate electronic systems, as new technologies and vendors emerge, as public-private relationships are formed, and as implementation occurs in systems of care that have different cultures and agendas.

Does a shared electronic medication list reduce medical errors and adverse drug events? Although it appears that medication list accuracy and practice culture improves, it is still not clear that primary clinical outcomes are affected by this intervention. Only through further research that randomizes 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 reduce their risk of adverse events by participating in this model of care.

Creating medication management processes and improving the culture of medication safety in the ambulatory care setting are 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 or not electronic tools are available.

Implementation of medication reconciliation and management processes is now occurring in all medical groups across all five PeaceHealth regions. Addressing medication management across the continuum of care has no doubt led to safer care of patients and has had a positive impact on clinic culture across the organization. However, it is a continuing challenge to work with nonaffiliated medical practice groups, specialty groups, pharmacies, long-term care facilities, and others who do not share the same culture or have competing priorities.

Throughout the implementation of this project, innovation and discovery continued to reveal important lessons about engaging patients, ambulatory medication management processes and the electronic tools necessary to support those processes, patients, and health care practices. The next step is to implement, further innovate, and test these tools and processes on a larger scale, such as across an entire community or health care system.

Author Affiliations

Center for Medical Education & Research, PeaceHealth Oregon Region (Dr. Stock, Ms. Minniti); PeaceHealth System Office (Dr. Mahoney, Ms. Gauthier, Ms. Center, Dr. Scott); St. Joseph Hospital, Bellingham, WA (Dr. Pierson); HInet, LLC Bellingham, WA (Ms. Nichols).

Address correspondence to: Ronald Stock, MD, Medical Director, Center for Medical Education & Research, PeaceHealth Oregon Region, 722 East 11th Street, P.O. Box 10482, Eugene, OR 97440; e-mail rstock@peacehealth.org.

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