FINAL REPORT

Demonstrating the Effectiveness of Patient Feedback in Improving the Accuracy of Medical Records

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This study was approved by the NORC Institutional Review Board under protocol number 110613. For more information, please contact Prashila Dullabh, the Project Director via phone, at (301) 634-9418 or e-mail at dullabh-prashila@norc.org.

Executive Summary

NORC at the University of Chicago (NORC) is pleased to present this final report on, "Demonstrating the Effectiveness of Patient Feedback in Improving in the Accuracy of Medical Records" to the Office of the National Coordinator for Health Information Technology (ONC). ONC's Office of Policy and Planning (OPP) contracted with NORC to conduct an assessment on the role of patients in improving the accuracy of information in their medical records. Providing patients with opportunities to give feedback rightly acknowledges that patient-generated information can enhance the accuracy and completeness of the medical record.

This project focused on data quality improvements that are likely to result from increased patient access to electronic health records (EHRs) and it explored solutions currently pursued by leaders in healthcare and other industries. Data quality is an umbrella term that encompasses accuracy, timeliness, accessibility, and clarity of presentation.[1] Phase 1 of the study examined the current state of the field, specifically the experience of healthcare organizations and approaches they are taking to encourage and process patient feedback. Phase 2 involved a pilot study at Geisinger Health System where patients were encouraged to provide feedback on their medication list within their EHR, in advance of patient visits. This final report demonstrates that patients can be effectively engaged online to improve the quality of the information stored in their EHRs. We hope that findings from the report will provide valuable insights to policy makers, researchers and the healthcare community on the important role of patient feedback to the medical record and how institutions can effectively gather and process this information with the ultimate goal of improving safety and the quality of treatment.

Background

With the widespread adoption of EHRs and advancement in health information exchange, providers will more readily exchange medical information about their patients with other providers, and patients will have more opportunities to engage with clinical teams about their medical records. While the goal of these interactions is to improve continuity of care and patient safety, the NORC 2010 environmental scan found patients with access to their medical information are likely to have questions, identify inaccuracies, or have information that may impact the data in their health records.

The research literature contains numerous studies documenting themes related to data quality that patient inspection and feedback could successfully address although the diversity of the studies makes direct comparison challenging. For example, a recent review of data quality studies[2] referenced two studies that

reported 81% and 95% errors in medication lists.[3, 4] Separate studies noted medication omission rates of about 27 percent for ambulatory oncology patients[5], and 53 percent for primary care patients.[6] In the same literature review, authors reported that studies of medication lists show significant errors. Inaccurate information was present in 81 to 95 percent of patient records. Errors due to retention of discontinued medications were common while incorrect medication regimens were less common.

Findings from the environmental scan also revealed that patients and doctors believe it is important to check the correctness of information in the EHR. A 2010 California Healthcare Foundation survey found "making sure that information is correct" is the personal health record feature most commonly cited as useful.[7] A 2010 Markle Foundation survey finds similar agreement between patients and providers on need for a correction process.[8]

To assess the current state of the field in the first phase of the project, we reviewed eight patient portals offered by integrated delivery systems. Not surprisingly, the attitudes and methods of patient engagement differed among the various patient portals and personal health record systems reviewed for the study. However, there were some clear preferences and healthcare organizations were generally requesting feedback on allergies, immunization data, and medications. There was significant variability in the approaches used to gather feedback and respond to queries. In most cases secure messaging or free text was used to gather patient feedback but in a few cases, for example Childrens Hospital Boston, NorthShore, University Health System and Kaiser Permanente, a focused form was also used. The backend processing that supports triage and routing messages varied considerably and ranged from a central triage desk manned by appropriate professionals to messages routed directly to providers.

For comparison, the environmental scan also considered industries outside of healthcare in which data quality is important. The most notable example of large-scale online problem-solving is the online auction site eBay. eBay's feedback rating system enables potential buyers to determine the reliability of a seller based on previous sales. When eBay began, the company refused to remove any contested feedback postings or to mediate differences of opinion between a buyer and a seller. The company soon realized, however, that it needed a process to adjudicate grievances and, if necessary, to remove feedback. eBay changed this practice after finding that resolving problems builds trust and acknowledging problems, rather than ignoring them, was better for business.

If EHR software does not allow users to report problems swiftly and easily, an accurate picture of care will not be available. Efficient communication of quality concerns can contribute to healthcare quality, improve care delivery, and build trust between patients and providers.

Overview of the Pilot Study

NORC partnered with Geisinger Health on a pilot study where patients were invited to provide feedback on their medication lists in advance of a scheduled doctor's visit. This project was initiated in November 2011, as part of a larger organizational initiative on medication reconciliation.

Overview of Geisinger. Geisinger Health System is a physician-led, not-for-profit, integrated delivery system that serves an area with approximately 2.6 million people in northeastern and central Pennsylvania. In 2002, Geisinger completed implementation of its outpatient EHR and uses the system across all of its group practice sites. At the time of the study 200,785 patients had active accounts on Geisinger's patient web portal, MyGeisinger, which they could use for health information, appointment scheduling, prescription ordering, checking lab results, e-mailing with clinicians, and to receive and act on clinical decision support.

Goals of the pilot. The pilot study had three goals: 1) Determine the interest of patients in becoming engaged to improve the accuracy of information in medical records; 2) Assess processes for obtaining and processing patient-generated feedback; and 3) Assess impact of the patient feedback.

MyGeisinger Pilot. The process for obtaining and processing online medication feedback can be summarized as follows:

- Patients were sent an electronic link to a medication feedback form, pre-populated with their current active medication list derived from their EHR record. Patients had the option of indicating which medication they were no longer taking, which they were taking differently from the way the instructions were presented, and which medication they were taking which were not listed.
- Patient responses were routed to a Geisinger pharmacist, who reviewed the patient's input, and attempted to follow up with the patient.
- Following the pharmacist review and possible patient contact, the pharmacist updated the medication record and notified the patient's physician and case manager (in cases where one has been assigned to the patient) about any changes by completing a note in the EHR.

Geisinger has been testing the process at two clinic sites. Inclusion criteria for the study target patients with specific chronic conditions (i.e., COPD, asthma, hypertension, diabetes or heart failure) who are active MyGeisinger users—patients who have logged in at least once and have at least one upcoming scheduled appointment with their primary care physician.

Methods

To study the intervention we used a mixed method approach. Qualitative activities included patient focus groups with three types of users: those who submitted a medication form, those who partially completed the form, and those who did not submit a medication feedback form. We also conducted user observations with patients that submitted the feedback form to gather additional perspectives from patients on the usability and usefulness of the form. Other qualitative activities included semi-structured discussions with the pharmacists and providers participating in the pilot study.

Quantitative methods included an analysis of four sets of data. 1) MyGeisinger usage data were obtained for all MyGeisinger users from January 2012 through June 2012 and for all patients who submitted completed medication feedback forms. 2) Demographic and health condition data, including age and sex, were obtained for the sample population (all patients that submitted a medication feedback form). 3) Medication feedback data (i.e., a count of the invitations sent and all completed responses) were obtained for the sample population.. 4) Pharmacist medication reconciliation logs for all patients who submitted a completed medication feedback form in response to invitations sent out in an eight-week period.

Key Findings

We gleaned many insights from the Geisinger pilot regarding how patients can be engaged to provide feedback, the workflow and processes that can support patient feedback, and the reliability of the information provided by patients. Below we summarize the most salient findings.

- **Patients are eager to provide feedback on their medication data and see numerous advantages.** Analysis of the quantitative data showed, 30 percent (457 of 1500) of patient feedback forms were completed and submitted to Geisinger. In 89 percent of cases (369 of 414 forms received) patients requested changes to their medication record. These included changes to frequency and/or dosages of existing medications and requests for new medications to be added. Patients requested changes to dosages and/or frequencies in 281 of 369 forms. The 281 forms included a total of 661 requests for changes to medication entries, for an average of 2.4 requested changes per patient form. Patient focus group findings suggest that most patients find that online access to their medication lists and an opportunity to provide feedback allows them to track their medications more easily. Patient access also enhances communication with their providers and better prepares them for office visits. Together, this increased access and communication allows patients to take a more active role in managing their medications.

- **Patients can provide useful and accurate information through online feedback systems**. In reviewing pharmacist responses for a sample of 107 forms submitted, in 68 percent of cases the pharmacists made changes to the MyGeisinger medication list based on patient feedback. The analysis showed that pharmacists accepted 51 percent of medication updates requested by the patients even when they could not contact them by phone and 67 percent changes when they could contact them. Discussions with pharmacists involved in the study suggest they were 'impressed' at the accuracy of the information provided by patients given that, on average, patients have 10.7 medications listed.
- **Processing patient feedback will require both software and human adjudication.** For the Geisinger pilot, pharmacists reviewed all feedback received from patients. In reviewing the medication forms, pharmacists regularly communicated with patients (and in some cases other pharmacists) as they reconciled patient feedback with the existing EHR record. Findings from patient focus groups suggest that patients found these communications with pharmacists reassuring and wanted assurance their information was reviewed by a trusted health professional before any changes were made in the medical record. However, on a large scale, review of all patient feedback, by a healthcare professional, could be a time and resource intensive prospect. The 51 percent of medications pharmacists updated without contacting patients present opportunities to facilitate human processing. Therefore, while a human intermediary would be necessary in some cases, others could proceed without human intervention and there are opportunities to automate processing of certain types of medication feedback data.
- Acceptance of online patient feedback system is more likely to work if there is an existing supportive overall e-health/online health environment. Review of usage data provided by Geisinger showed that patients who completed the medication feedback form accessed MyGeisinger 2.3 times the average and initiated secure messages 1.35 times as often. In the focus groups, patients reported finding MyGeisinger useful and physicians were very responsive to patient online communication as providers often responded to secure messages within a couple of hours.

- **Software can facilitate the HIPAA goals of access and amendment.** The HIPAA Privacy Rule provides individuals the right to examine and obtain a copy of one's health information and a right to request an amendment to information in the record. EHRs do not change these rights. They may provide easier and more effective ways for patients to exercise these rights and for providers to meet HIPAA requirements. Findings from the Geisinger pilot suggest an online portal combined with efficient and secure communications options will meet the needs of patients who might otherwise wish to exercise these rights. Medication reconciliation provides an opportunity for a patient to update some critical information in one's record and for collaboration between patients and providers, as opposed to a formal amendment request under HIPAA.

Conclusions

Findings from the Geisinger pilot demonstrate that patients can be effectively engaged online to improve the accuracy of the information stored in their EHRs. It has provided valuable insights into effective strategies to gather patient feedback, to organize the back-end workflow and processing of patient feedback and to provide an opportunity for EHRs to assist in maintaining accurate and complete medical records. Furthermore, the data shows that patients are eager to provide feedback and the information they provide is likely to result in more accurate and up-to-date information. In many ways online medication reconciliation provides a model for collaborative processes that can be employed to improve the quality of problem lists, immunizations, allergies and other areas of the medical record. The Geisinger pilot has highlighted a number of areas that would benefit from additional study. These include studies to optimize form elements for patient feedback in other areas of the medical record such as medications and allergies; methods to efficiently automate form processing, mapping the impact on physician office workflow; and assessing outcomes related to cost, patient quality, and safety.

In conclusion, we observed an example of how the goal of patient engagement was achieved seamlessly through patient/provider collaboration via the electronic health records.

Introduction

NORC at the University of Chicago and the National Center for Technology and Dispute Resolution at the University of Massachusetts, Amherst, are pleased to present this report entitled "Demonstrating the Effectiveness of Patient Feedback in Improving in the Accuracy of Medical Records" for ONC. ONC's Office of Policy and Planning (OPP) contracted with NORC to conduct an assessment on the role of patients in improving the accuracy of information in their medical records.

A key objective of the Federal Health IT Strategic Plan is to "accelerate individual and caregiver access to their electronic health information in a format they can use and reuse." [9] The 2009 HITECH Act was a major milestone on the road to achieving this objective. In developing an evolving set of standards for providers to demonstrate Meaningful Use (MU) of EHRs, HITECH gave health IT adoption institutional backing and established a road map for providers to use electronic record systems and technologies in a "meaningful way."

The NORC project had two phases. Phase 1 of the study explored the current state of the field, specifically integrated delivery systems and approaches they are taking to encourage and process patient feedback. Phase 2 involved a pilot study at Geisinger Health System where patients were encouraged to provide feedback on their medication list within their EHR, in advance of a doctor's visit. The focus of this report is phase 2 of the study.

One of the five key goals of the MU objectives, tied to improving outcomes while also reducing medical errors, is patient engagement. Stage 1 MU, includes three required core measures and two of the ten elective menu measures for both ambulatory providers and hospitals to improve patients' engagement with their care, particularly during the times between office visits. Increasing the accessibility of medical records to patients allows them to improve their accuracy The three core measures under Stage 1 MU that assess patient engagement are: 1) clinical summaries are provided to patients for more than 50 percent of all office visits within three business days, 2) more than 50 percent of requesting patients receive an electronic copy of their health information—including diagnostic test results, problem list, medication list, and medication allergies—within three business days, and 3) patients are provided with an electronic copy of their discharge instructions at the time of their discharge and upon request. The two measures included under the optional or menu set are: 1) more than 10 percent of patients are provided with patient specific education resources, and 2) more than 10 percent of patients are provided with electronic access to information within four days of it being updated in the EHR. [10]

The final Stage 2 criteria for MU include requirements that EHR systems: 1) Use secure electronic messaging to communicate with patients on relevant health information; 2) Ensure that more than 5 percent of all unique patients seen by the Eligible Provider (EP) view, download or transmit their health information to a third party; 3) Allow more than 50 percent of patients seen by the EP during the EHR reporting period timely online access to their EHR; and 4) Provide patient-specific educational resources identified by Certified EHR Technology (CEHRT) to more than 10 percent of patients with office visits seen by the EP during the EHR reporting period.[11] Some preliminary discussion by the Health IT Policy Committee Meaningful Use Workgroup has suggested incorporation of patient feedback is under consideration for Stage 3.[12] Although the form such a measure will take remains to be seen, it is clear patient engagement remains a policy priority as future stages of Meaningful Use are developed.

Findings from an environmental scan performed in the first phase of the study, indicate data quality problems in health records, both paper and electronic, are widely known.

Studies regularly show wide variability of Common Procedure and Treatment codes, Evaluation andmanagement Coding (E&M), and International Classification for Disease (ICD) -9 coding accuracy.[13,14,15,16,17] The medication list has also been cited by several studies as a site of low data quality.[18,19,20,21,22] Possible causes of poor data quality include issues inherent in the EHR system, the specific context in which the EHR is used, technical limitations related to semantic and syntactic interoperability, clinician interview skills, and patients providing imperfect data. Data quality encompasses numerous criteria, and even if a problematic entry is identified, determining the cause and its remedy requires time and, often, clinical training.[23]

Concerns about data quality are present throughout information technology, and disciplines exist to characterize and control for data quality across applications.[24] Within the health IT sector, the issues have not gone unnoticed. Discussions have urged data quality efforts.[25] The Department of Defense Data Quality Management Control Program, for example, has required data quality officers be present at each of its health care facilities[26], and the Institute of Medicine considers patient engagement tools to be an important component of discussions about health IT and patient safety.[27]

Medication reconciliation programs have been a prominent part of medical safety programs.[28,29,30,31] Interventions have found high levels of discrepancies in medication lists, even when medication reconciliation protocols are followed, with common types of discrepancies including missing over the counter (OTC) medications and listing prescriptions that the patient was no longer taking.[32,33,34] As a way of improving accuracy, ONC has been advised by the Certification/Adoption Workgroup of the Health IT

Policy Committee that "Mechanisms that make it easier for patients to report inaccurate or questionable data need to be encouraged as 'best practices.'"[35]

In the sections that follow, we begin with key findings from the environmental scan completed in phase 1 of the project, followed by a detailed description and key findings of phase 2 of the project.

Background

As widespread adoption of EHRs and other health information technology (IT) rises, providers will be able to more readily exchange medical information about their patients and patients will have more opportunities to engage with clinical teams about their medical records. While the goal of these interactions is to improve continuity of care and patient safety, the NORC 2010 environmental scan found patients with access to their medical information are likely to provide updates to or have questions about the data in their health records. Patient inquiries may involve concerns with lab data values, missing updates or information from another provider, inaccuracies in a diagnosis, a problem or allergy list, or a statement in a doctor's notes. Patient engagement tools have the potential to leverage patients' interest in their health and care regimen. Addressing patient concerns about the accuracy of information in the medical record may improve the quality of these records, but the time burden required to assess and resolve them is a challenge. Improved patient engagement must develop in tandem with systems and procedures to minimize resource use, including staff time.

Networked personal health records are one such patient engagement tool, combining a patient-facing portal with an external source of data, such as a provider's EHR system or insurance claim data.[36] Surveys indicate that large numbers of patients are interested in using such a portal or have access to one already.[37,38] Studies have also shown that patients are interested in using a portal to verify that their health information is correct and to help manage their care.[39,40,41]

The team reviewed eight patient portals. While the systems show great similarities in the data that is being displayed to patients, this contrasts with a lack of consensus on how to best engage patients or process the feedback obtained from patients. Most make available vital signs, problem lists in some fashion, medication lists, allergies, immunizations, laboratory results, radiology reports, and clinical summaries. To date, none have made clinical encounter notes available. Outpatient rather than inpatient data is generally more available.

Analysis (see Table 1) showed feedback on allergies, immunizations, and medication lists are areas where requests for correction are facilitated and in some cases encouraged. *Encouraging* feedback involves text on the page that acknowledges the potential for issues and recommends that a patient contact their provider. *Facilitating* feedback takes the additional step of providing online mechanisms to accept patient input; a variety of different approaches are used to facilitate feedback and respond to inquiries. All of the patient portals studied have secure messaging functions available to encourage communication with providers about data quality. In most cases, the secure messaging function supports free text, but in a few cases, focused forms are also used.

Table 1: Capabilities of Surveyed Patient-Facing Portals

Health Data	Available Online	Encourage Feedback	Facilitate Feedback
Medication Lists	8	2	3
Allergies	7	1	4
Immunizations	6	1	3
Laboratory Results	7	1	1
Problem Lists and Diagnosis	6	1	1
Vital Signs	5	1	1
Clinical Summary & Discharge Instructions	6	1	0
Radiology Results	5	0	1
Medical History, incl. Procedures	5	1	0
Clinical Encounter Notes	0	0	0

The backend processes that support the triage and routing of messages vary greatly; some sites use a service center model where all messages are routed through a central facility and then dispersed to the appropriate provider, while others use a process where messages are sent directly to the practices. It is noteworthy that for organizations that centrally triage messages, procedures at the message center are largely manual and a customer service representative reads, triages and routes messages. Once the messages reach the individual provider offices, the specific processes on how they are reviewed and responded to vary greatly, and we found no consistent approach. We note that even systems based on a single commercial software package differ in their approach, and there has been no experimental evaluation of the efficacy of any approach or a comparison between approaches.

Informants stressed the need to take into account the concerns that providers have on how to effectively manage patient input and reduce providers' time burdens while still encouraging patient engagement.

Providers fear that opening a medical record to people who lack medical training will lead to instances of confusion. Past studies have evaluated patient engagement in relationship to e-mail communication between providers and patients. These studies have identified four of the categories in Table 2 as barriers to provider adoption of e-mail communication by their patients[42]: Provider workload and time demands, Inappropriate use of online mechanisms by patients, Lack of provider reimbursement, and Confidentiality and Security Liability. These barriers are similar to those long acknowledged for other types of online patient engagement including access to EHRs[43], access to visit notes[44], and wider varieties of online interactions.[45] Nearly all of the barriers cited both by this project's key informants and in prior studies were presented from the provider's perspective. The only category that respondents chose to put in terms of the patient's perspective was patient awareness of their ability to provide input. Three respondents felt patients were unaware of their right to correct data or chose to be passive, and so engagement tools would be under-utilized.

Table 2: Barrier Cited During Interviews (N=17)

Category	Instances
Provider workload & time demands	10
Provider difficulty of establishing correct content	6
Inappropriate use of online mechanisms by patients	5
Provider difficulty of correcting errors	5
Provider lack of guidance on appropriate practices	5
Lack of provider reimbursement	4
Provider liability concerns	3
Patient awareness of their ability to provide input	3
Technical limitations of EHR systems	2
Confidentiality and security liability concerns	1

Software that provides access to one's record simply by logging in creates, in effect, a substitute for a written request under HIPAA to examine one's record. Our sense was that it also changes the patient-provider environment since the more frequently the patient looks at the EHR, the more frequently the patient will be concerned about data present in the record. Members of the NORC team have experience advising on processes for updating and correcting systems in other contexts in which electronic records are maintained and data quality is important. While the medical context has certain unique features and demands, the development of alternative or informal dispute resolution processes that are quick and convenient inevitably becomes a user's expectation when a problem is identified.

Our experience in these non-medical contexts can provide guidance on how to value patient contributions to medical records. Entities that have developed procedures for responding to user queries include financial institutions such as credit bureaus, credit card issuers and banks, firms that supply information about work histories, and e-commerce and other online sites that create reputations that potential users of a site consider before making a purchase or using a service. Some of these are guided by laws that, like HIPAA, mandate consumer access to one's record. Others simply allow access in the absence of legislation, having determined that consumer participation is necessary for improving the data quality of the records and that building trust in any enterprise requires the correction of errors. Some deal with extraordinarily large numbers of consumer interactions. eBay, for example, handled over sixty million disputes in 2011. The challenge of scale and of understanding the source and value of user-submitted information, in other words, is an issue in medical and non-medical contexts but a challenge worth engaging in given the trust and data quality that results from user input.

Overview of the Geisinger Pilot

For phase 2 of the study NORC secured the participation of Geisinger Health System. Geisinger serves an area with approximately 2.6 million people in northeastern and central Pennsylvania. Its annual patient volume exceeds 40,000 inpatient discharges and 2.4 million outpatient visits, and the system employs more than 900 physicians in 42 practice sites, all of which include primary care.

Geisinger completed implementation of its outpatient EHR in 2002 and uses the system across all of its group practice sites. The system, which also incorporates decision support, now contains more than three million patient records. At the time of the study, more than 200,785 patients had active accounts on Geisinger's patient web portal, MyGeisinger, which they could use for health information, appointment scheduling, prescription ordering, checking lab results, e-mailing with clinicians, and to receive and act on clinical decision support.

In November 2011, Geisinger launched an online patient medication feedback process as part of its broader medication reconciliation effort. Geisinger patients with upcoming doctors' appointments were invited to go online to update a list of medications stored in their EHR. They were shown the medications' generic name and its brand name, if any, as well as instructions that came with the medication such as frequency, dosage, route and other directions. They had the option of indicating which medication they were no longer taking, which they were taking differently from the way the instructions were presented, and which medication they were taking which were not listed.

Pharmacists, who were trained as medical therapists, reviewed patients' input, if it was received before the appointment, and updated the patients EHR. Pharmacists were instructed to accept a limited set of changes unless they could contact the patient by phone. These changes were limited to discontinuations, new over-the-counter medications and corrections of obvious clerical errors, such as removal of a duplicate prescription. Schedule 1, 2, 3 and 4 controlled substances were not entered unless the fulfilling pharmacist is contacted.

The process was initiated as a pilot study at two of Geisinger's outpatient clinics. Approximately 40 new invitations were issued per week. The patients who had been selected to participate had specific chronic conditions (i.e., COPD, asthma, hypertension, diabetes or heart failure). They were considered active MyGeisinger users based on their having logged in at least once. Appendix A includes a more detailed presentation of the process.

Methodology

The NORC team used a mixed method approach to study the intervention. Qualitative methods included informant discussions with key project staff, patient focus groups and user observations with patients. Quantitative methods included analysis of patient-submitted data, a review of pharmacists' medication reconciliation logs, usage data and patient demographic information. We had three primary aims for assessing the intervention. In Table 3 below, we list the primary aims and research questions for the pilot study.

Table 3: Key Research Questions and Methods

Goals	Key Research Questions
Goal 1: Determine if patients can be engaged to improve the quality of information in medical records	▪ Will patients be engaged to provide feedback? ▪ Will patients provide feedback? ▪ What factors influence whether patients provide feedback?
Goal 2: Assess processes for obtaining and processing patient-generated feedback	▪ If and how should patient feedback be triaged? ▪ What processes are needed to process patient feedback? ▪ What processes are needed to make updates/amendments to the medical record?
Goal 3: Assess impact of the patient feedback	▪ How accurate is the feedback? ▪ What is the impact of patient feedback on providers and patients? ▪ Does patient feedback contribute to more up-to-date/accurate records?

Evaluation Methods

Evaluation methods included: 1) focus groups with users, non-users and partial users of the patient-feedback form; 2) semi-structured interviews with providers and pharmacists; 3) user observations with patients; and 4) quantitative analysis of patient feedback data and pharmacists medication reconciliation logs.

- Patient Focus groups (user, non-users, partial-users). Four ninety-minute group meetings were held at the Henry Hood Center for Health Research in Danville, Pennsylvania from May 15 – May 17, 2012. A total of 22 Geisinger patients participated. (Reference Appendix B for discussion protocols). Table 4 includes key themes covered in the patient focus groups.

Table 4: Discussion Themes from Patient Focus Groups

Stakeholder group	Focus Group Themes
Patients	▪ Previous medication management practices ▪ Experiences with the patient feedback form ▪ Suggestions on how to improve the user interface ▪ Challenges encountered and additional functions desired ▪ Expectations about how inquiries are resolved (e.g. when a nurse, pharmacist, or some other staffer handles the response)

- Patient User Observations. A total of seven user observations were conducted to gain context-based insights into how the patient uses the medication feedback form and their relationships with health providers, as well as into the overall healthcare delivery process. During the observation, participants were asked to demonstrate how they would use the medication feedback.
- Key informant discussions (pharmacists and physicians). NORC conducted sixty-minute semi-structured discussions with two pharmacists and four physicians. The two pharmacists interviewed are trained medical therapists and the primary pharmacists responsible for reviewing all patient medication feedback forms. We discussed general themes that included previous medication reconciliation processes, experiences with the patient feedback from and review and processing of patient feedback. (Table 5)

Table 5: Discussion Themes for Providers and Pharmacists

Stakeholder group	Discussion Themes
Providers	▪ Previous medication management practices ▪ Experiences with the tool ▪ Attitudes toward patient-supplied information ▪ Suggestions for how to improve the message triage workflow ▪ Challenges and barriers encountered
Pharmacists	▪ Previous medication management practices ▪ Impressions of the tool ▪ Types of inquiries received ▪ Suggestions for how to improve the message triage workflow

Quantitative Data

- MyGeisinger Usage Data. This was obtained for all MyGeisinger users from January 2012 through June 2012 and for all patients who submitted completed medication feedback forms from invitations sent out during the period from November 2011 through June 11, 2012. All patients that completed a medications feedback form were included in the sample population.

- Demographic and Health Condition Data. Age, sex and chronic conditions were obtained for the sample population.
- Medication Feedback Data. A count of the invitations sent and all completed responses obtained for the sample population. For the sample population, three categories of information were analyzed:
  1. Patient requests for changes/updates to medications stored in their Geisinger EHR.
  2. Patient requests for additions of prescribed medications they were taking that are not included in their Geisinger EHR.
  3. Patient requests for additions of non-prescription medications they were taking that are not included in their Geisinger EHR, such as inhalers, vitamins, supplements, and ointments.
- Pharmacist Medication Reconciliation Logs. NORC received a record of pharmacists responses, for all patients who submitted a completed medication feedback form in response to invitations sent out in an eight-week period, from April 17, 2012 to June 11, 2012. Pharmacists responses were broken down into four categories:
  1. No record found in the patient's EHR indicating the pharmacist processed the form.
  2. Medication feedback form received by the pharmacists after the patient's scheduled office visit.
  3. Medication feedback form received by the pharmacists before the patient's scheduled visit. There were two subcategories in this group:
     a. Pharmacist attempted to contact the patient after receiving the medication feedback form but was not able to speak to them on the phone.
     b. Pharmacist was able to contact the patient by phone.

For each feedback case in categories 2, 3a, and 3b, NORC obtained a record of all medications shown to the patient and the pharmacist's response to the patient request for changes/updates. These changes included any discontinuations and new entries made by the pharmacists. NORC collaborated with Geisinger to develop a coding scheme for pharmacist responses (see Appendix A for coding approach). All pharmacist responses were coded by Geisinger based on the approved coding scheme. NORC verified the coding by reviewing patient feedback logs and pharmacist responses. In cases where NORC identified issues with the coding, these cases were discussed with Geisinger and, if appropriate, recoded.

The quantitative analysis was intended to be used in conjunction with the qualitative analysis, as the findings provided further avenues of research to be explored with more comprehensive data. In Table 6 below, we identify the key measures of interest for the pilot.

Table 6: Key Metric to be included in the Study

MEASURES
Count of patients invited to complete the medication feedback form
Count and percentage of patients that participated broken down by those who completed the medication feedback form and those who did not complete the form
Age of respondents
Count of the number of forms in which patients requested changes to their medications
Count of the total number of changes requested by patients
Percentage of forms, and total medications changes identified by the pharmacists
Count of the types of medication list changes: addition of new medications, removal of medications, changes in frequency and dosages
MyGeisinger usage rates
Opinion of MyGeisigner and preference for its usage

Analytic Approach

For the qualitative data we summarized all the notes from the focus groups, user observations and key informant discussions with providers and pharmacists. We had two members of the team review the notes and extract common themes.

For the quantitative data, our analytic approach involved descriptive statistics of selected measures as allowed by data availability and relevance to understanding patient feedback and pharmacist reconciliation. This includes information on MyGeisinger usage rates, patient-requested changes to their Geisinger medication list, and pharmacist actions. Calculations and data management were done in Microsoft Excel 2010 and SAS 9.2.

Study Limitations

- Findings from the medication feedback study were from one institution only. While we recognize this limitation, we note Geisinger was the only identified organization studying the use of a patient-feedback form for medication lists.
- A limited number of pharmacists and physicians were involved in the pilot hence qualitative findings may not be broadly generalizable to all Geisinger pharmacists and physicians.

- Since the patient form data file is based on two sources, namely, the EHR and survey questionnaire software, there may be unidentified issues in the data integration process.
- The pharmacist encounter data file is also based on two sources, the data warehouse and the pharmacist's report. A manual process was used to verify line-by-line the matching of patients to the medication to the pharmacist action (if any). As a result of these issues, the accuracy of the data and therefore, the analysis, is dependent on how well the data mining process was understood by the researchers.
- The scope of the project was to assess how patients can be engaged and the reliability of the information they provide. Consequently limited analysis was conducted on patients that did not submit the medication feedback form. We recognize there may be additional insights to be gathered from patients that did not submit the form but this was considered out of scope for this phase of the project.

Analysis of Qualitative Data

We begin this section with findings from the focus groups and user observations followed by discussions with pharmacists and providers. We conclude this section with findings from the analyses of quantitative data.

Key Findings from Focus Groups

Most participants are long-time users of MyGesinger, with some reporting they signed up for portal access when it launched in 2002. MyGeisinger usage varies from twice a week to once a month. Many patients describe using MyGeisinger to schedule appointments, refill prescriptions, review test results, track medications, learn about procedures/tests, and send secure messages to physicians. Most participants reported they enjoy the convenience of using technology to manage their health and communicate with providers.

Most participants see benefits in having medication feedback available online. The benefits include convenience of electronic access, enhanced ability to track and monitor medications for themselves and other members of their family, and being better prepared for their doctors' visits. Many participants indicated they use the form to prepare questions and key discussion points for their physicians during office visits. Additionally, they like to bring a printed copy of the form to office visits to reduce the time spent on medication reconciliation so they can address other concerns with the physician. Several participants indicated prior to office visits, they received a blank form in the mail requesting that they list all of their medications. While some participants found this confusing, others opted to use the online form, which was pre-populated with their medications and consequently seemed more convenient to complete.

> *"I take 30 or so meds. I probably wouldn't be able to list all of them on my own. The form helps me remember to take all of my meds and request refills."*

Many participants indicated the form allows them to take a proactive role in managing their medications. They feel more informed about their health care and are more confident when asking questions about medications during office visits. Some participants agreed their feedback on the medication list was essential since they are the primary individuals who can attest to their body's response to a medication. A few

> *"I can trust my doctors when they're making decisions, but I need to gauge how a drug makes me feel – that's something they can't know."*

patients also noted having access to the medication feedback form reduced the need for an office visit as it provided an opportunity for patients to communicate about their medications and issues they were experiencing without having to schedule a doctor's visit.

While patients are eager to provide feedback, they would like a more consistent feedback loop and an assurance a healthcare professional is reviewing their data before changes are made to the medical record. A few patients reported they thought the form was an annual survey and did not realize that it was a tool to provide feedback on the accuracy of their medical records. These participants noted they received several other surveys from Geisinger and consequently the clinical significance of the medication feedback form was lost on them. A few participants appeared to be confused about what happened to their information once they submitted feedback and did not know a pharmacist reviewed the information. A few patients remembered receiving a phone call or a secure e-mail from a pharmacist. Most participants however were unaware the completed medication feedback form was reviewed by pharmacists. When participants were informed a pharmacist reviewed the information they felt reassured.

There also appeared to be inconsistencies in patient experiences regarding how quickly updates were made to the medication list. Some participants saw their changes to the medication list reflected immediately while others did not see changes being made promptly. Patients reported it would have been helpful to get an acknowledgement from Geisinger indicating the information they submitted had been received and was being reviewed.

Patient feedback on their medications is clinically significant. Several patients indicated they take various over-the-counter medications, vitamins, and supplements. These medications were not included on their med lists initially so they had to add them using the form. A few participants noted the form stopped them from taking medications that could have been detrimental to their health because of harmful interactions with their other medications. Patients also reported discontinued medications still being listed as active/current medications and differences in the frequency with which they were currently taking medications relative to what was listed in MyGeisinger.

> *"I had surgery and started taking B-12 vitamins. I reported this on the form. I received a follow up phone call from a provider to stop taking the vitamins to prevent overdose since I was already receiving B-12 injections."*

Patients felt there is no 'one size fits all' approach in terms of how often feedback forms should be submitted and clinical need should dictate this. Some participants reported their chronic conditions were well managed and they had limited changes in medications between visits. Consequently they had less

need to submit feedback on their medication lists prior to each doctor's visit. A few patients also indicated they did not like receiving multiple requests to complete the form since no changes needed to be made. These participants noted that too frequent requests may decrease the likelihood of patients thoroughly reviewing the med list each time. Most patients generally felt having a feedback form available at all times would be optimal. In this way patients could submit changes whenever they noted discrepancies in their MyGeisinger medication list.

A few participants taking several medications indicated they submitted multiple medication feedback forms before their medication list was up-to-date. These additional efforts caused some to question whether the form was an effective way of making changes to their medication list and an efficient use of their time.

Most participants reported the form was easy to understand and use but had suggestions on how to enhance usability. Patients reported it took anywhere from 3-30 minutes depending on the number of medications on the list and the extent of the changes. Most participants that completed the form found it self-explanatory. Patients, however, provided suggestions about form elements, navigation as well as additional tools and resources to enhance their understanding of their medication lists.

- **Many participants reported confusion with generic meds vs. brand name meds.** Participants indicated the form listed brand name medication, but they were taking the generic brand of the drug. Additionally, a few patients noticed their pills were a different color or shape when they refilled their medications, which added confusion when completing the form. Some participants reported sending secure messages to their physicians through MyGeisinger, others conducted online research to confirm that the brand name listed on the form was the same medication as the generic brand. They reported that this extra step increased the time needed to complete the form. A participating pharmacist confirmed both the brand and generic names of medications are listed on the form if available, however this is not consistently the case. Physicians noted they see many patients with different insurances so they are unsure which medications the patients will receive from the pharmacy. Sometimes the pharmacist calls the physician to ask what to prescribe or to confirm if a substitution is the same medication the physician prescribed to the patient.

- **Some patients would like to have decision support aids linked to their medications.** Some participants reported it would be helpful having their medications hyperlinked to patient education resources such as side effects, harmful interactions, and general information. They also suggested the decision support aids should be geared toward non-medical audiences. A few participants suggested the form include flags when patients attempt to enter changes that can be detrimental to their health. For example, if patients attempt to switch to a higher dosage of a medication or enter a medication that causes a harmful interaction with a medication already listed, an alert would be presented to the patient. Patients requested other enhancements to the form as reflected in Table 7.

Table 7: Suggested Enhancements to Medication Feedback Form

Issue	Suggested Enhancement
Ambiguous questions caused confusion when changing the frequency or dosage of a medication	▪ Allow patients to indicate the dosage when they are taking a medication less often. ▪ Allow patients to edit the frequency of a med without requiring them to indicate that they are not taking the med as prescribed. Patients may take meds according to the verbal instructions they received.
Some questions were too vague or not adequately distinguished	Make the form more specific and descriptive when asking questions.
Lack of important fields such as prescribing doctor	Add this field so patients can indicate who instructed them to change/discontinue medications
Lack of adequate response options	Include more response options so that patients can indicate if someone else other than a doctor or pharmacist told them not to take a med.
Response selection	Include check boxes to allow patients to choose more than one response if they spoke to multiple individuals about their medications.
Medication search	Include a medication search feature so that the form auto-populates the name of a med as a patient types it.
Follow up option	Allow patients to request a follow up call from Geisinger at the end of the form.
Some visual aspects of the form have the potential to confuse patients	▪ Eliminate the changes in color that result when patients update their meds to avoid confusing patients with vision problems. ▪ Some of the buttons need to be consistent with other screens.
Patients should not be forced to update all medications;	▪ Patients should select the meds they want to update instead of being forces to complete a set of questions for each medication ▪ Add a save and continue feature; patients can start the form and come back later to complete it
The form has too many screens	▪ Reduce the number of screens. ▪ Allow patients to enter all changes on one screen so they don't have to toggle back and forth to previous screens.
History of changes made to the med list	Allow patients to see a record of all of the changes that have been made to their med list.

Patients would like the opportunity to provide feedback on other aspects of their medical record. Patients expressed a desire to provide feedback on chart notes, medical history, immunizations, allergies, and procedures done by outside physicians. Some participant noted that having specialized feedback forms, for different parts of the medical record would be helpful. A participant suggested that Geisinger develop condition-specific tools that facilitate data submitted by patients in addition to their feedback.

> *"The form is a good tool. If I had access to other parts of my record, I'd definitely take a look at it."*

Key Findings from Physicians and Pharmacists

Physicians and pharmacists communicate frequently using various online tools. In addition to EHR encounter notes, Geisinger pharmacists and doctors communicate about patient medications using secure messaging and instant messaging. Both pharmacists and doctors appreciated having frequent and almost real-time communication regarding patient medications and felt this led to better quality of care overall.

Pharmacists report that patient feedback has improved the accuracy of medication list and were surprised by patient interest and responsiveness to providing information on their medications. Both pharmacists indicated patients were diligent in reporting over-the-counter medications and adding drugs prescribed by physicians outside of Geisinger. Patients also updated dosages and reported meds that were discontinued by their physicians, improving the quality of their medication records. The pharmacists reported being surprised by the accuracy of the medication list changes submitted by patients, how involved patients were and the level of computer proficiency. Initially pharmacists had some reservations about the accuracy of patient feedback, but found that most patients—including those taking >20 medications—accurately documented each of their medications in the form without any errors. Anecdotally the pharmacists reported that in 80% of cases, patient feedback was accepted and resulted in changes to the medication record.

> *"It's amazing to see the response we've received and the details patients have provided so far. They are very thorough. I had a 91-year-old male patient who went through the survey completely. I assumed that a family member helped him complete the form, but then I talked to him and found out that he did it all by himself."*

The medication feedback form has improved patient engagement, communication, and information sharing. Both pharmacists and physicians reported the form prompts patients to thoroughly review their medications. During office visits, some patients discuss with their physicians how they reviewed their meds at home and they share a printed copy of the form. The form offered patients an opportunity to let provider know they stopped taking a medication, without having to wait for their next doctor's appointment.

Pharmacists and physicians report efficiencies in the medication reconciliation process and minimum disruptions in workflow at the point of care. A physician reported the pilot study runs smoothly and he has not experienced any disruptions to his workflow from the form's implementation. A physician reported he spends less time reconciling medications with patients who complete and bring a printed copy of the form to their visits. One provider reported spending half the usual amount of time on medication reconciliation, which is a huge time savings given doctors often have only 15 minutes per patient.

Similarly, both pharmacists noted collecting medication feedback from patients has been a seamless process. Pharmacists reported that on average it took about 2.5 minutes to process a medication feedback form.

Physicians were generally unaware of the details of the pilot study and were looking for more information. Of the four physicians we spoke to, three were unaware of the details of the study. In discussions with key project staff for the pilot, we learned physicians receive a staff message and progress note from pharmacists when a change is made to a patient's med list. Since physicians typically receive between 30-200 staff messages per day, the pharmacists message on the actions they took on the patient medications may get 'buried' in the other messages. Furthermore, in studying the medication reconciliation workflow at Geisinger, when a pharmacist updates a patient's medications, a note is placed at the bottom of the medication list indicating who made the last update. During the patient's visit, a nurse is required to reconcile the patient's medications and consequently the pharmacist's name is replaced with that of a nurse as she is the last person that reviewed the medication list. When the physician completes his/her medication reconciliation the pharmacist's action may not be obvious to the provider.

Two of the physicians noted it would be helpful to review the initial set of feedback provided by patients. One of the physicians felt it would assist her in assessing patients' knowledge regarding their medication lists and uncover issues patients may forget to bring up during the office encounter. Knowing this information will help physicians determine if they need to take alternative approaches to teach patients about their medications.

Analysis of Patient Feedback Data

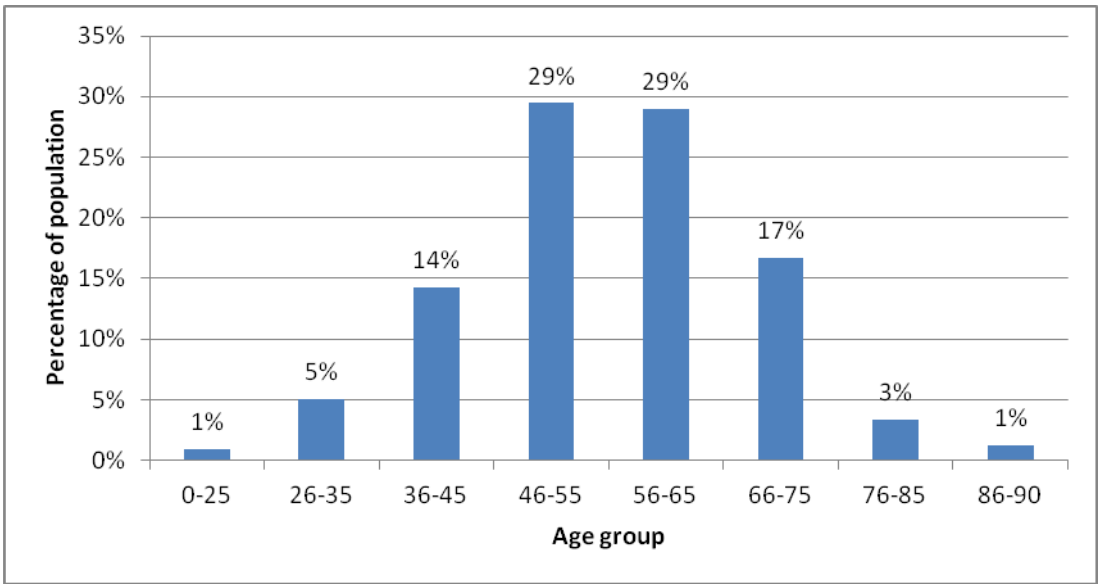
In this section we present findings from the quantitative data analysis. We begin this section with an analysis of patient feedback data, continue with a detailed sub-sample analysis of pharmacists processing of the patient feedback data and conclude with an analysis of usage rates and opinions of MyGeisinger.

Analysis of Patient Feedback Data

Between November 2011 and June 2012, Geisinger sent out 1500 feedback forms, 457 were returned completed for a response rate of 30 percent. The NORC analysis included a sample size of 414 responses. Forty-three responses were removed because they either came from patients less than 18 or greater than 90 years of age or were issued during the first week of the pilot. These younger and older patients could not be included due to Geisinger Institutional Review Board requirements around sharing information that might enable unique patient identification. Data from the first week of the pilot were dropped due to poor data quality resulting from technical issues experienced by Geisinger in pre-populating the medication feedback forms sent to the patient.

Patient Demographics. Exhibit A shows the age distribution of patients who completed the feedback form. Patients in the age groups of 46 to 55 and 56 to 65 years old combined, account for almost 60 percent of the population.

Exhibit A: Age Group Distribution of Patients who Completed the Feedback Form



Source: Patient feedback forms collected from November 2011-June 2012

Count of patient medications. The 414 pre-populated medication lists had a total of 4,422 medications listed. The number of medications per patient ranged from 1 to 44, with a mean of 10.7.

Volume and Nature of Patient Feedback

Patient medication feedback data was segmented into three categories: 1) feedback received on medications that were on the Geisinger pre-populated medication list (which can include both prescription and over-the-counter medications); 2) feedback received on prescription medications the patients said they were taking not on Geisinger pre-populated medication list; and 3) feedback received on over-the-counter medications the patients said they were taking not on the Geisinger pre-populated medication list.

Patients requested changes in the majority of medication feedback forms submitted. Out of a total of 414 patient feedback forms, patients requested changes to their medication list in 369 forms (89% of submitted forms) (See Table 8). Patient requested changes include all three categories.

Table 8: Patient Requests for changes to their EHR Medication Lists (N=414)

	N	%
Number of forms in which patients requested changes	369	89%
Number of forms in which patients did not request a change	45	11%
Total number of forms submitted	414	100%

Source: Patient feedback forms collected from November 2011-June 2012

- In the analysis of patient feedback forms in category 1 (feedback received on medications that are on the pre-populated medication list) patients identified discontinuations or changes in frequency or dosage in 281 forms (67.9% of submitted forms). The 281 forms included a total of 661 requests for changes to medication entries (see Table 9), for an average of 2.4 requested changes per patient form requesting any changes. The 661 requested updates represent 15 percent of the total medications on the pre-populated medication lists.

Table 9: Patient Request for Changes in EHR Medication List

	Number of forms in which patients requested discontinuations or changes in frequency or dosage	Number of medications entries requested to be removed or changed
Patient requests	281	661

Source: Patient feedback forms collected from November 2011-June 2012

- In the analysis of patient feedback forms in category 2 (feedback received on prescription medications not on the pre-populated medication list), patients listed additional prescription medications on 82 forms (20% of submitted forms). The 82 forms included a total of 141 requested additions to Geisinger medication list (see Table 10), for an average of 1.7 requested additions per patient form.
- In the analysis of patient feedback forms in category 3 (feedback received on over-the-counter medications not on the pre-populated medication list), patients listed additional over-the-counter medications on 257 forms (62% of submitted forms; Table 10). Since multiple over-the-counter medications along with free-text comments could be listed in a single data field, we did not conduct a manual count of how many new medications were listed.[1]
- For patient feedback in categories 2 and 3 (feedback received on prescription and over-the-counter medications not on the pre-populated medication list), patients listed additional prescription or over-the-counter medications on 284 forms (69% of submitted forms; Table 10).

Table 10: Number of forms in which patients requested additional prescription or over-the-counter medications

	Number of forms in which patients requested documentation of additional prescription medications	Number of additions requested
Patient requests	82	141

	Number of forms in which patients requested documentation of additional over-the-counter medications	Number of additions requested
Patient requests	257	-

	Number of forms in which patients requested documentation of additional prescription or over-the-counter medications	Number of additions requested
Patient requests	284	-

Source: Patient feedback forms collected from November 2011-June 2012

[1] A study of a subsample of 107 forms submitted between 4/17/2012 to 6/11/2012, found 65 forms where patients requested documentation of new over-the-counter medications. The number of additions requested totaled 178 for an average of 2.7 per form.

Analysis of Pharmacist Medication Reconciliation Logs

Rationale for subsample analysis. In order to assess the validity of patient responses (i.e., assess to what extent patient feedback resulted in changes to the Geisinger medical record), a subsample analysis for patient feedback forms collected over an eight week period was conducted (4/17/2012 to 6/11/2012). We opted for a subsample analysis for two reasons; 1) Due to time and resource constraints, we were unable to obtain pharmacist data coded for the full sample of 414 patients; and 2)By choosing the latest responses, the most stable view of the intervention could be obtained.

Subsample Analysis. Geisinger extracted all pharmacist EHR actions in response to patient input for the time period to be analyzed. NORC collaborated with Geisinger in coding patient medication entries into 20 categories (see Appendix C) that represent the possible outcomes of patient feedback in combination with pharmacist action (e.g., whether the pharmacist noted the discontinuation of a medication as requested by a patient). As explained in Appendix C, pharmacist processes differed depending on which of three situations arose:

1. The patient's office appointment occurred before the pharmacist could process the patient's feedback.

2. The pharmacist was able to process the patient's feedback, but was unable to contact the patient on the phone.

3. The pharmacist was able to discuss the patient feedback with the patient on the phone before processing the feedback.

A total of 116 patient forms were included in the sub-sample analysis (no pharmacists data was found for 4 additional records). See Table 11 for a breakdown of medication feedback forms received categorized by pharmacist actions. The nine cases where the patient saw their provider prior to the pharmacists processing their medication feedback form are excluded in the subsequent analysis.

Table 11: Patient Feedback Forms Categorized by pharmacist's actions

Scenarios	Number of patient forms	Patient request Number of forms in which patients reported discontinuations, or changes in frequency or dosage	Patient request Number of medication entries patients requested be removed or changed	Pharmacist action Number of forms pharmacist accepted for changes	Pharmacist action Number of medications changed by pharmacist based on patient feedback
		6	10	1	1
Pharmacists attempted to contact patient, but no answer	77	43	82	28	42
Pharmacists spoke to patient on the phone	30	19	39	14	26
Total	116	68	131	43	69

Source: Patient feedback forms collected from 4/17/2012 to 6/11/2012 and pharmacist medication reconciliation logs

Patients can provide accurate and valid feedback on their medication list. This can be seen by looking at the percentages of patient updates accepted by pharmacists shown in the table above. In the situations where pharmacists could process the patient's input before their office visit, they accepted 68 of the 121 updates that were submitted, for a 56 percent acceptance rate. Since the sub-sample analysis does not include any requests patients made for documentation of new medications (prescribed medications or over the counter medications), these counts represent an undercounting of data accuracy improvements that are likely to result from online patient feedback.

Pharmacists or another healthcare intermediary have an important role to play. In the sub-sample analysis we also did a comparison of the number of medications changed by the pharmacists when they spoke to the patient compared to the situation where a pharmacist contacted the patient but was not successful in reaching them on the phone. When the pharmacist spoke to the patient, the pharmacist made changes to 67 percent of the medications compared to 51 percent when the pharmacists were not able to get the patient on the phone. While we recognize the sample sizes are small, this data suggests that pharmacists (or another healthcare intermediary) have an important role to play in adjudicating patient input. The data also suggests that some changes could be made to the medication record without patient-professional interaction. Further analysis is required to determine to what extent patient-generated feedback on medication lists can be automatically preprocessed through enhanced form filtering and other clinical decision support aides embedded in software in order to reduce the demand on professionals.

MyGeisinger Usage Rates

During the period from January to June 2012, 200,785 had activated MyGeisinger accounts. Of those, 111,700 were "active" in the sense that they had logged in at least once during this time period.
To assess MyGeisinger usage rates of the patients completing the medication feedback form, we reviewed data provided by Geisinger on average patient log-ins to MyGeisinger and the number of secure messages initiated by patients (patients responses to other secure messages sent to them are not included.) Based on a literature review, secure messaging was often included as a measure of usage rates for patient portals and/or PHRs.[46]

Patients who submitted medication feedback forms appear to be more active users of MyGeisinger. We obtained usage data for two groups; patients included in the pilot and for all 'active' users of MyGeisinger (See Table 12). Patients in the pilot who submitted the medication form log-in to MyGeisinger more than twice as often as patients who are not part of the pilot study on average (63 log-ins per year for patients who submitted the medication feedback form compared to 27 log-ins per year for all patients that were active users of MyGeisinger). Review of secure messaging usage rates suggests patients who submitted the medication feedback form send secure messages more often than other active users of MyGeisinger (10.2 secure messages initiated per year for patients who submitted the medication feedback form compared to 7.6 secure messages initiated for patients who were not included in the study).

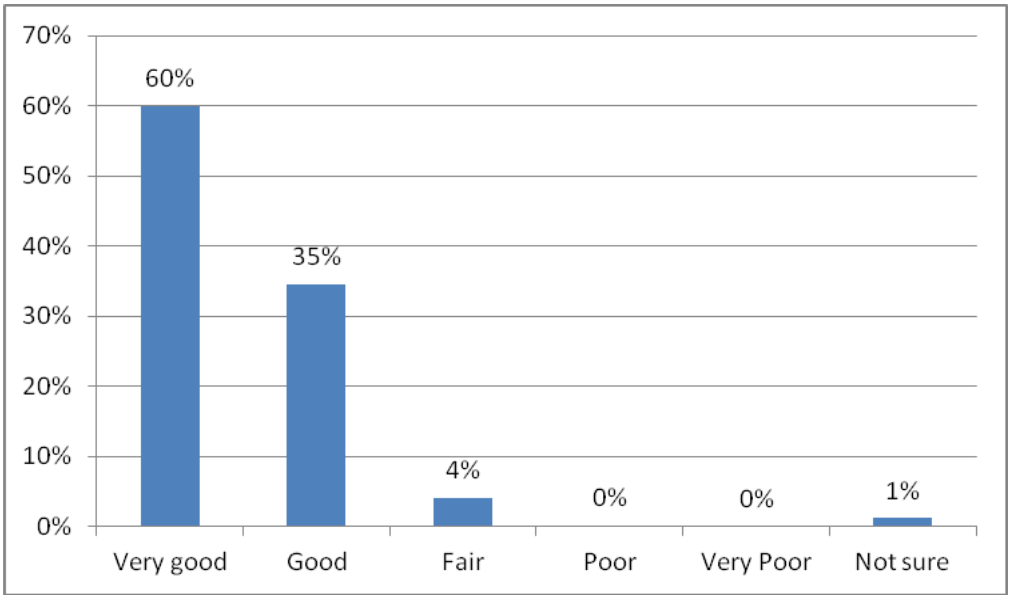
Table 12: MyGeisinger Usage Rates Annualized for 2012

Usage Measures	Description	Annual Rates
Log-ins by all active users	average number of log-ins to MyGeisinger	27
Logins by active users who submitted the medication feedback form	average number of log-ins to MyGeisinger	63
MyGeisinger secure-messaging by active users who did not submit the medication feedback form	average number of secure messages	7.6
MyGeisinger secure-messaging by active users who submitted the medication feedback form	average number of secure messages	10.2

Source: MyGeisinger Audit Logs (2012)

Answers to the medication feedback forms survey support this conclusion. Exhibit B shows patients who completed the form have a high opinion of MyGeisinger. When asked how they would like to receive responses to questions 250 of the 257 who responded chose "MyGeisinger Message" over "Phone call." In summary patients in the study appear to be more active and satisfied users of MyGeisinger compared to all other MyGeisinger patients.

Exhibit B: Patient responses to the question "Overall, what is your opinion of MyGeisinger?"



Source: Patient Feedback Form

Discussion

We have gleaned many insights from the Geisinger pilot regarding how patients can be engaged to provide feedback and how to organize care processes that support patient feedback and maximize reliability of the information provided by patients. Below we summarize the most salient findings.

- **Patients are eager to provide feedback on their medication list and see numerous advantages.** As the quantitative data showed, 30 percent (457 of 1500) of medication feedback forms were completed with 61 percent (281 of 457) of those requesting discontinuations or changes in frequency or dosage to the medications stored in their EHR and 62 percent (284 of 457) presenting new medications. Cumulatively in 89 percent of cases (369 of 414 forms received) patients requested changes to their medication record. Patient focus group findings suggest that most patients find that online access to their medication lists and an opportunity to provide feedback allows them to track their medications more easily. Patient access also improves communication with their providers in that it better prepares them for office visits. Taken together, this increased access and communication allows patients to take a more active role in managing their medications.
- **Patients can provide useful and accurate information through online feedback systems**. As the subsample analysis of detailed pharmacist logs for the 107 forms showed, pharmacists accepted 51 percent (42 of 82) of medication discontinuations or changes requested by the patients even when they could not contact them by phone and 67 percent of (26 of 39) changes when they could contact them. Anecdotal information shared by pharmacists involved in the study suggests that they implemented patient requests for changes in more than 80 percent of cases. In discussion groups, providers at the pilot sites indicated that when patients are able to review and provide feedback on their medication lists online, medication reconciliation is more efficient during in-person medical visits.

- **Processing patient feedback will require both software and human adjudication.** For the Geisinger pilot, pharmacists reviewed all feedback received from patients. In reviewing the medication forms, pharmacists regularly communicated with patients (and in some cases other pharmacists) as they used patient feedback to update the EHR record. Findings from patient focus groups suggest that patients found these communications with pharmacists reassuring. They were pleased that the feedback they provided was assessed by a trusted health professional before any changes were made in the medical record. However, on a large scale, human assessment could be a time- and resource-intensive prospect. Findings from discussions with pharmacists suggest there are opportunities to employ decision support rules within the EHR to automate the processing of certain types of medication feedback without pharmacist intervention, for example, automatically accepting forms that request no changes or removing medications that patients indicate they have completed and which in the EHR are shown to have expired. This is supported by the fact that even when the patients could not be contacted 51 percent of their suggested discontinuations and changes were accepted. Therefore, while a human intermediary would be necessary in some cases, others changes could proceed without or with minimal human intervention. In the next phase of the study, Geisinger will assess the feasibility of implementing decision support rules to create efficiencies in the medication feedback process that will allow them to process larger numbers of patient requests for changes more cost-effectively.
- Acceptance of online patient feedback system is more likely to work because of an existing supportive overall e-health/online health environment. Findings from the Geisinger pilot suggest that for the patient feedback process to work, an environment that encourages and supports online consumer interaction is necessary. Usage data from the two pilot sites indicates that, on average, 30 percent of patients at each site are active users of MyGeisinger (consistent with overall Geisinger use rates). In the focus groups, most patients expressed satisfaction with using MyGeisinger to perform various convenience functions like scheduling appointments, requesting refill prescriptions, reviewing test results, tracking medications, learning about procedures/tests, and sending secure messages to physicians. Patients also reported finding online interactions meaningful, as Geisinger is very responsive to patient online communication; providers often respond to secure messages within a couple of hours, and use the portal to send preventive-health and appointment reminders and to communicate other relevant information to the patient. The relation is further suggested by the quantitative analysis that shows patients who complete the medication feedback form log into MyGeisinger 2.3 times more than MyGeisinger users not in the pilot (63 versus 27) and initiate secure messages 1.35 times as often (10.2 versus 7.6).

- **Software can facilitate the HIPAA goals of access and amendment.** HIPAA envisions a formal process revolving around two rights, a right to examine one's medical record and a right to request an amendment if one disputes something in the record. EHRs do not change these rights but they do provide support for alternative and less formal processes that patients can employ to correct or challenge something in the record. The Geisinger pilot alerted us to how an online portal combined with efficient and secure communications options will often make it unnecessary for a patient to formally assert a HIPAA right in order to achieve the goals envisioned by HIPAA, namely access and amendment of one's record. Medication reconciliation may be more of an updating process than an amending one and more collaboration between patients and providers than a formal amendment request under HIPAA. In the medication reconciliation process, too, the request for information and the use of a process for making changes often originates with the provider. In many ways, however, online medication reconciliation will also provide a model for collaborative processes that can be employed to improve the quality of problem lists and many other elements of the EHR. What we observed was an example of how the goal of patient engagement, of patient and provider collaborating on managing the patient's health, rather seamlessly came to also include patient-provider collaboration on the patient's medical record.

Conclusions and Policy Implications

Findings from the Geisinger pilot provided valuable insights into effective strategies to gather and process patient feedback, organize the back-end workflow and take advantage of opportunities for EHRs to offer patients a less formal way to update their medical records than the right afforded to them under HIPAA. Furthermore, the data shows that patients are eager to provide feedback and the information they provide is likely to results in more accurate and up- to-date information. In many ways, online medication reconciliation provides a model for collaborative processes that can be employed to improve the accuracy of other areas of the medical record including problem lists, immunization and allergies. Many of these findings have important implications for the current deliberations around Stage 3 MU criteria, specifically as it relates to the inclusion of patient-generated data and information reconciliation.

The Geisinger pilot also highlighted a number of areas for immediate study. These include studies to optimize form elements for patient feedback for other areas of the medical record, opportunities to automate form processing and analysis of patient feedback, the impact of patient feedback on physician office workflow and outcomes related to cost, patient quality and safety.

At the heart of any data-improvement or problem-solving process is communication. Our experience with Geisinger illustrated that providing opportunities for communication is a necessary but not sufficient first step. Geisinger recognized processes for communicating must be accompanied by attention given to ease of use, accessibility and processes for encouraging patients to use the system.

As more patients become familiar with their EHRs and as use of new communication tools accelerates, problems and concerns associated with their records will inevitably be noticed. Interactions between patients and providers will increase and not all such interactions will be frictionless. A few of the many possible sources of such problems and the factors affecting them include unintended miscommunications, unfamiliar and complex software, and changes in roles and relationships. Findings from this study suggests that a well-structured online environment and a cooperative and conscientious community of healthcare providers who utilize it for effective communication can lead to better data quality within the EHR.

Appendix A: Overview of Pilot Workflow and Data Workflow

Included in the outpatient EHR that Geisinger Health System operates are the medications their patients are taking. This includes prescription medications that were ordered by Geisinger staff, prescriptions that were ordered by outside caregivers and non-prescription medications. As part of office visits, Geisinger includes medication reconciliation by the rooming nurse and by the physician. Before their scheduled office visits, Geisinger mails patients a blank form with instructions to fill in the list of their active medications and to bring the list with them to their appointment.

The online patient medication feedback process essentially adds a prefilled online version of the blank form and a pharmacist performing the reconciliation to the existing process. Exhibit H shows the workflow and, in parallel, the associated data flow. The details of the workflow follow.

Step 1: Patient invited to update medication list in advance of appointment

Ten to sixteen days in advance of their scheduled office appointment, patients are invited to update their medication list online. The invitations are sent via MyGeisinger's secure messaging system and, if the patient's have registered an external e-mail address, to that address. The invitation contains an electronic link to a medication feedback form hosted in an online electronic data capture system, DatStat. Patients must log into MyGeisinger to access the feedback system. If needed a reminder is sent to the patient one-week later using the same mechanisms.

Step 2: Patient completes medication feedback form

The medication feedback form consists of a home screen with the patient's complete medication list from his EHR record. Table 13 gives some example entries, which show generic description, brand names, frequency, dosage and other instructions.

Table 13: Examples of Medication Entries Shown to Geisinger Patients on the Medication Feedback Form

Medication Entries
Diltiazem HCl Coated Beads Tab SR 24HR 240 MG (CARDIZEM LA 240 MG PO TB24); one tab twice daily
Furosemide Tab 40 MG (FUROSEMIDE 40 MG PO TABS); one tab by mouth daily
Ibuprofen Tab 800 MG (MOTRIN 800 MG PO TABS); as needed

The patient is given the option of confirming they are taking the medications as prescribed. If they indicate either that they are not or are unsure, they are then asked to select a reason from the choices

shown in Table 14. Selections 6 and 9 allow the patient to enter a free-text elaboration.. Patients are also given a free-text comment field. This field is often used to enter a new frequency or dosage.

Table 14: Reasons Patients Can Select From for Explaining Why They Are Not Taking Medications as Prescribed

	Not taking a medication as prescribed because:
1.	My doctor instructed me to take at a different frequency/dosage
2.	My pharmacist instructed me to take at a different frequency/dosage
3.	My prescription shows I should take it at a different frequency/dosage
4.	I was instructed to stop taking this medication
5.	I am not taking this medication
6.	I did not want to take it as prescribed. Why Not?
7.	I was trying to make medication last longer
8.	I did not understand how I was supposed to take it
9.	Other reason

Patients are given the option of entering any other prescribed medication. They provide the prescription name, the frequency, the dosage, and when they started the medication. They also have the option of indicating any problems they are having with the medication.

Patients are given the option of entering the names of non-prescription medications they are taking. The categories supplied are shown in Table 15.

Table 15: Categories of non-prescription medications patients are invited to enter

Categories of non-prescription medications
Inhalers/breathing medications
Vitamins or Supplements
Other over-the-counter medications
Medications you put on your skin such as creams, lotions or ointments

The form includes two survey questions: “How often do you look at your medication list on-line at MyGeisinger?” and “Overall, what is your opinion about MyGeisinger?” The final screen allows patients to ask any specific questions they wish about their medications and to indicate if they wish to receive a response via a MyGeisinger message or a phone call. Once patients submit the form, they cannot submit the form again. Step 3: Pharmacist reviews patient submitted medication list

Pharmacists are sent batches of data from completed medication feedback forms twice per week. The information has been extracted from DatStat and entered into a Microsoft Access database.

There are three distinct workflows:

1. The preferred workflow is for the pharmacists to phone all patients to ask any appropriate entries about their submission. If the patient requests the addition of a Schedule 1, 2, 3 or 4 controlled substance, the pharmacists does not comply unless a fulfilling pharmacist is contacted to verify the addition.

2. If the pharmacist cannot contact the patient after two tries they are instructed to limit the updates they accept to discontinuations, new over-the-counter medications and corrections of obvious clerical errors, such as removal of a duplicate prescription.

3. If the pharmacist cannot review the submitted medication list before the patient's scheduled visit, they have the option of not acting on any updates.

Step 4: Pharmacist updates electronic medical record

The pharmacist updates the medication record, records an "encounter note" recording any changes or issues, and passes the note on as a secure message on to the patient's physician and if applicable the case manager, if one has been assigned to the patient. The encounter note is stored in an the outpatient EHR. (A change in frequency or dosage requires discontinuation of the original medication-list item and a new order for the medication that contains the current frequency or dosage.)

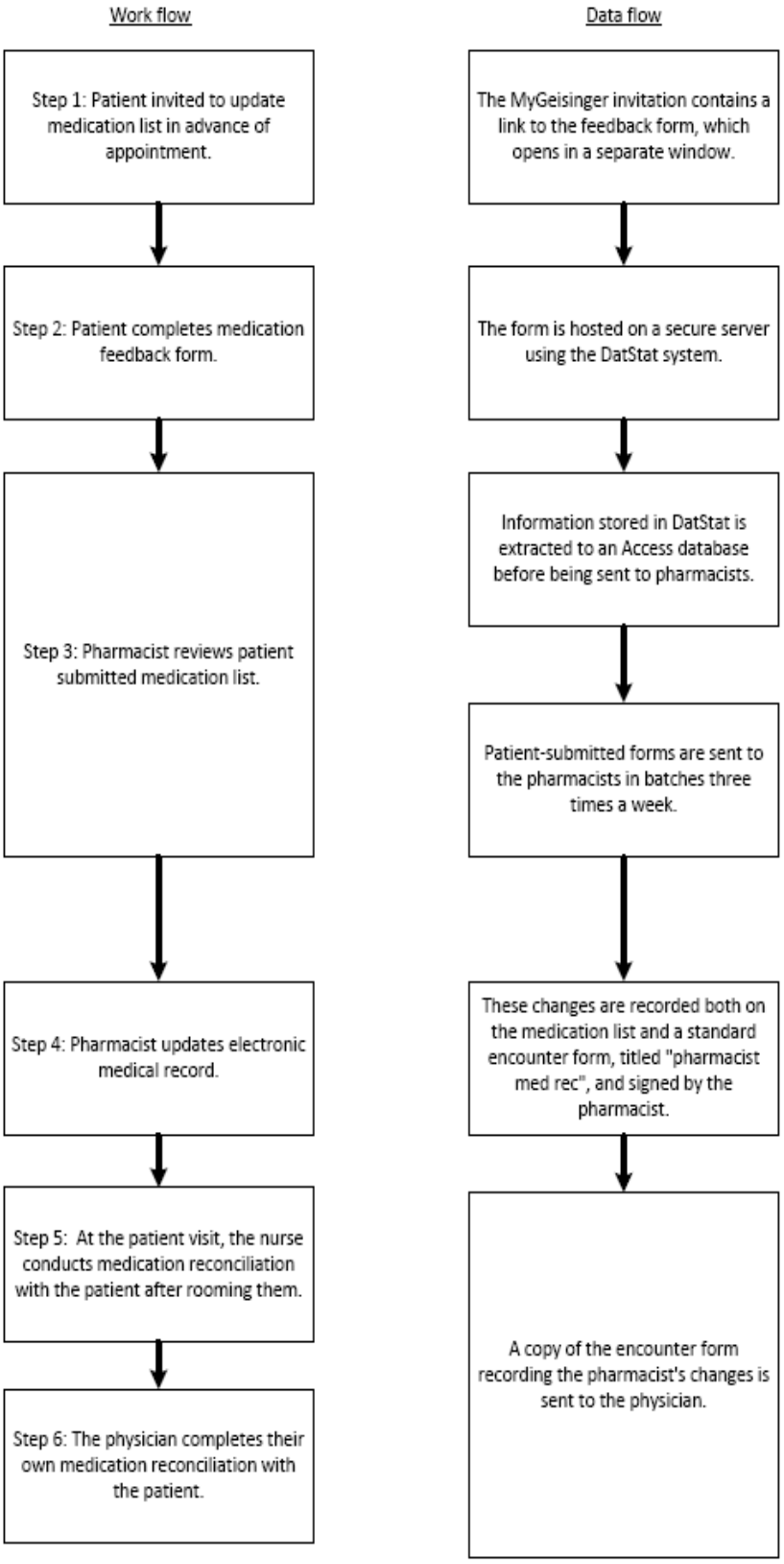
Step 5: At the patient visit, the nurse conducts medication reconciliation with the patient after rooming them

This step is unchanged from the pre-existing process.

Step 6: The physician completes medication reconciliation with the patient

During the appointment, physicians perform their medication reconciliation, informed by any encounter note sent them by a pharmacist in Step 4.

Exhibit C: Overview of Pilot Workflow and Dataflow



Appendix B: Permutations Table

Pharmacist encounter EPIC medications outcomes

Outcome #	Patient form response	Pharmacist encounter?	1st pharmacist action	2nd pharmacist action	No pharmacist action	Typical Reasons
1	Patient taking med as prescribed	pharmacist encounter	discontinued	ordered	-	Refills; Change in dosage/frequency
2	Patient taking med as prescribed	pharmacist encounter	discontinued	-	-	Verified via phone call with patient; No answer when called; Same medication entered twice in Epic
3	Patient taking med as prescribed	pharmacist encounter	-	ordered	-	Illogical
4	Patient taking med as prescribed	pharmacist encounter	-	-	no changes	Verified via phone call with patient; No answer when called; Saw PCP prior to pharmacist encounter
5	Patient taking med as prescribed	no pharmacist encounter	-	-	no changes	Did not have time to reconcile
6	Patient not taking med as prescribed	pharmacist encounter	discontinued	ordered	-	Refills; change in dosage/frequency
7	Patient not taking med as prescribed	pharmacist encounter	discontinued	-	-	Verified via phone call with patient; No answer when called; Saw PCP prior to pharmacist encounter; Same medication entered twice in Epic
8	Patient not taking med as prescribed	pharmacist encounter	-	ordered	-	Illogical
9	Patient not taking med as prescribed	pharmacist encounter	-	-	no changes	Verified via phone call with patient; No answer when called; Saw PCP prior to pharmacist encounter; Deferral to nurse/physician; Patient has not started yet; PRN medication
10	Patient not taking med as prescribed	no pharmacist encounter	-	-	no changes	Did not have time to reconcile

Pharmacist encounter additional and other medications (including creams, vitamins, OTCs and inhalers) outcomes

Outcome #	Patient form response	Pharmacist encounter?	1st pharmacist action	2nd pharmacist action	No pharmacist action	Typical Reasons
11	Patient indicated new med	pharmacist encounter	ordered	discontinued	-	Medication actually in record,
12	Patient indicated new med	pharmacist encounter	ordered	-	-	Verified via phone call with patient; No answer when called
13	Patient indicated new med	pharmacist encounter	-	discontinued	-	Unlikely: Medication already in record and Verified via phone call with patient
14	Patient indicated new med	pharmacist encounter	-	-	no changes	Verified via phone call with patient; No answer when called; Saw PCP prior to pharmacist encounter; Deferral to nurse/physician; Medication already in record per patient history; New medication started after questionnaire sent to patient
15	Patient indicated new med	no pharmacist encounter	-	-	no changes	Did not have time to reconcile
16	Patient did not indicate new med	pharmacist encounter	ordered	discontinued	-	Verified via phone call with patient
17	Patient did not indicate new med	pharmacist encounter	ordered	-	-	Verified via phone call with patient
18	Patient did not indicate new med	pharmacist encounter	-	discontinued	-	Verified via phone call with patient; No answer when called; Medication already in record per patient history; Same medication entered twice in Epic
19	Patient did not indicate new med	pharmacist encounter	-	-	no changes	Verified via phone call with patient; No answer when called; Saw PCP prior to pharmacist encounter; Medication already in record per patient history; New medication started after questionnaire sent to patient
20	Patient did not indicate new med	no pharmacist encounter	-	-	no changes	Illogical

Appendix C: Bibliography

[1] Markle Foundation. *The Connecting for Health Common Framework: Background Issues on Data Quality*. Apr 2006. Accessed online Apr 12, 2010 at: www.connectingforhealth.org/commonframework/docs/T5_Background_Issues_Data.pdf

[2] Chan KS, Fowles JB, Weiner JP. Review: Electronic health records and reliability and validity of quality measures: A review of the literature. *Med Care Res Rev*, 2010; 67(5). Epub: http://mcr.sagepub.com/content/67/5/503.

[3] Kaboli PJ, McClimon BJ, Hoth AB, Barnett MJ. Assessing the accuracy of computerized medication histories. *Am J Manag Care*, 2004; 10(11 Pt 2): 872-877

[4] Weingart, S. N., Cleary, A., Seger, A., Eng, T. K., Saadeh, M., Gross, A., et al. Medication reconciliation in ambulatory oncology. Joint Commission Journal on Quality and Patient Safety, 2007; 33(12), 750-757.

[5] Weingart, S. N., Cleary, A., Seger, A., Eng, T. K., Saadeh, M., Gross, A., et al. Medication reconciliation in ambulatory oncology. Joint Commission Journal on Quality and Patient Safety, 2007; 33(12), 750-757.

[6] Varkey, P., Cunningham, J., & Bisping, D. S. (2007). Improving medication reconciliation in the outpatient setting. Joint Commission Journal on Quality and Patient Safety, 2007; 33(5), 286-292.

[7] California HealthCare Foundation. Consumers and Health Information Technology: A National Survey. [Online]. 2010. [Cited 2012 June 29] Available from: http://www.chcf.org/publications/2010/04/consumers-and-health-information-technology-a-national-survey

[8] Markle Foundation. Markle Survey: The Public Expects Benefits from Health IT Public and Doctors Agree on Importance of Specific Privacy Safeguards. [Online]. 2010 Dec 3. [Cited 2012 June 29] Available from: http://www.markle.org/sites/default/files/20101203_phr_roundtable.pdf

[9] Office of the National Coordinator for Health Information Technology. Federal Health Information Technology Strategic Plan 2011-1015. [Online]. 2011. [Cited 2011 August 15] Available from: http://healthit.hhs.gov/StrategicPlan

[10] *Federal Register*, Jul 28, 2010; 75(144): 44370-44375

[11] Centers for Medicare and Medicaid Services. Stage 1 vs. Stage 2 Comparison Table for Eligible Professionals. [Online]. August 2012. [Cited 2012 August 28] Available from: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Stage_2.html

[12] Office of the National Coordinator for Health Information Technology, Meaningful Use Workgroup: Past Meetings. [Online, cited 2012 May 23] Available from: http://healthit.hhs.gov/portal/server.pt?open=512&objID=1472&&PageID=17094&mode=2#042010

[13] Campbell SE, Campbell MK, Grimshaw JM, Walker AE. A systematic review of discharge coding accuracy.*J Public Health*, 2001; 23(3): 205-211.

[14] Hogan WR, Wagner MM. Accuracy of data in computer-based patient records. *J Am Med Inform Assoc*, Sept/Oct 1997; 4(5): 342-355.

[15] Thiru K, Hassey A, Sullivan F. Systematic review of scope and quality of electronic patient record data in primary care. *Brit Med J,* May 17, 2003; 326: 1070. doi:10.1136/bmj.326.7398.1070.

[16] Jordan K, Porcheret M, Croft P. Quality of morbidity coding in general practice computerized medical records: a systematic review. *Fam Pract*, 2004; 21(4): 396-412.

[17] Chan KS, Fowles JB, Weiner JP. Review: Electronic health records and reliability and validity of quality measures: A review of the literature. *Med Care Res Rev*, Oct 2010, 67(5). Epub: http://mcr.sagepub.com/content/67/5/503.

[18] Kripalani S, Jackson AT, Schnipper JL, Coleman EA. Promoting effective transitions of care at hospital discharge: A review of key issues for hospitalists. *J Hosp Med*, 2007; 2(5): 314-323. doi: 10.1002/jhm.228

[19] Weingart, S. N., Cleary, A., Seger, A., Eng, T. K., Saadeh, M., Gross, A., et al. Medication reconciliation in ambulatory oncology. Joint Commission Journal on Quality and Patient Safety, 2007; 33(12), 750-757..

[20] Varkey, P., Cunningham, J., & Bisping, D. S. (2007). Improving medication reconciliation in the outpatient setting. Joint Commission Journal on Quality and Patient Safety, 2007; 33(5), 286-292.

[21] Kaboli PJ, McClimon BJ, Hoth AB, Barnett MJ. Assessing the accuracy of computerized medication histories. *Am J Manag Care*, 2004; 10(11 Pt 2): 872-877.

[22] Staroselsky M, Volk LA, Tsurikova R, Newmark LP, Lippincott M, Litvak I, Kittler A, Wang T, Wald J, Bates DW.. An effort to improve electronic health record medication list accuracy between visits: Patients' and physicians' response. *Int J Med Inform*, 2008; 77(3): 153-160.

[23] Varkey, P., Cunningham, J., & Bisping, D. S. (2007). Improving medication reconciliation in the outpatient setting. Joint Commission Journal on Quality and Patient Safety, 2007; 33(5), 286-292.

[24] Some of the more popular books include *Data Quality Assessment* by Arkady Maydanchik, Technics Publications, LLC (May 14, 2007); *Executing Data Quality Projects: Ten Steps to Quality Data and Trusted Information* by Danette McGilvray, Morgan Kaufmann (Jul 25, 2008); *Improving Data Warehouse and Business Information Quality: Methods for Reducing Costs and Increasing Profits* by Larry P. English, Wiley, 1st ed. (Mar 11, 1999).

[25] For example, Markle Foundation. *The Connecting for Health Common Framework: Background Issues on Data Quality*. Apr 2006. Accessed online Apr 12, 2010 at: www.connectingforhealth.org/commonframework/docs/T5_Background_Issues_ Data.pdf

[26] Accessed online at: http://www.tricare.mil/ocfo/mcfs/dqmcp.cfm

[27] Institute of Medicine. Health IT and Patient Safety: Building Safer Systems for Better Care. Report, 2012. [Online, cited 2012 June 29] Available at: http://books.nap.edu/openbook.php?record_id=13269
See Chapter 5: Patients' and Families' Use of Health IT: Concerns About Safety.

[28] Medication reconciliation. AHRQ Patient Safety Primer. Accessed online Oct 5, 2010 at: http://www.psnet.ahrq.gov/primer.aspx?primerID=1

[29] *Medication Reconciliation Handbook*. Oakbrook Terrace, IL: Joint Commission Resources and the American Society of Health-System Pharmacists, 2006. ISBN: 0866889566.

[30] Delate T, Chester EA, Stubbings TW, Barnes CA. Clinical outcomes of a home-based medication reconciliation program after discharge from a skilled nursing facility. Pharmacotherapy. 2008 Apr;28(4):444-52.

[31] Bassi J, Lau F, Bardal S. Use of information technology in medication reconciliation: a scoping review. Ann Pharmacother. 2010 May;44(5):885-97. Epub 2010 Apr 6.

[32] Stewart AL, Lynch KJ. Identifying discrepancies in electronic medical records through pharmacist medication reconciliation. J Am Pharm Assoc, 2012 Jan-Feb;52(1):59-66.

[33] Orrico KB. Sources and types of discrepancies between electronic medical records and actual outpatient medication use. J Manag Care Pharm. 2008 Sep;14(7):626-31.

[34] Peyton L, Ramser K, Hamann G, et al. Evaluation of medication reconciliation in an ambulatory setting before and after pharmacist intervention. J Am Pharm Assoc. 2010 Jul-Aug;50(4):490-5.

[35] Certification/Adoption Workgroup. Health IT Policy Committee, Office of the National Coordinator. Apr 22, 2010 recommendations. Accessed online at: http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__policy_recommendations/1815

[36] Institute of Medicine. Health IT and Patient Safety: Building Safer Systems for Better Care. Report, 2012. [Online, cited 2012 June 29] Available at: http://books.nap.edu/openbook.php?record_id=13269See Chapter 5: Patients' and Families' Use of Health IT: Concerns About Safety.

[37] Markle Foundation. Americans Overwhelmingly Believe Electronic Personal Health Records Could Improve Their Health. [Online]. June 2008. [Cited 2012 June 29] Available from: http://www.markle.org/sites/default/files/ResearchBrief-200806.pdf

[38] Manhattan Research. Cybercitizen Health® U.S. 2011 (survey). [Online, cited 2012 June 27] Available at: http://manhattanresearch.com/News-and-Events/Press-Releases/ehr-consumer-online-medical-records

[39] California HealthCare Foundation. Consumers and Health Information Technology: A National Survey. [Online]. 2010. [Cited 2012 June 29] Available from: http://www.chcf.org/publications/2010/04/consumers-and-health-information-technology-a-national-survey

[40] Markle Foundation. Markle Survey: The Public Expects Benefits from Health IT Public and Doctors Agree on Importance of Specific Privacy Safeguards. [Online]. 2010 Dec 3. [Cited 2012 June 29] Available from: http://www.markle.org/sites/default/files/20101203_phr_roundtable.pdf

[41] Wakefield DS, Kruse RL, Wakefield BJ, et al. Consistency of Patient Preferences About a Secure Internet-Based Patient Communications Portal: Contemplating, Enrolling, and Using. Am J Med Qual. 2012 Apr 18. [Epub ahead of print]

[42] Ye J, Rust G, Fry-Johnson Y, Strothers H. E-mail in patient-provider communication: A systematic review. Patient Educ and Couns. 2010;80(2):266-273.

[43] Ross SE, Todd J, Moore LA, Beaty BL, Wittevrongel L, Lin CT. Expectations of Patients and Physicians Regarding Patient-Accessible Medical Records. Med Internet Res. 2005 Apr-Jun; 7(2): e13.

[44] Delbanco T, Walker J, Darer JD, Elmore JG, Feldman HJ, Leveille SG, Ralston JD, Ross SE, Vodicka E, Weber VD. Open notes: Doctors and patients signing on. Ann of Intern Med, Jul 20, 2010; 153(2): 121-125.

[45] MacDonald K, Case J, Metzger J. E-Encounters. California HealthCare Foundation. [Online]. 2001 Nov. [Cited 2011 August 15] Available from: http://www.chcf.org/publications/2001/11/eencounters

[46] Silvestre Al, Valerie MS, Allen JY. If You Build It, Will They Come? The Kaiser Permanente Model of Online Health Care, 2009; 28(2): 334-344.