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# How Patients Can Improve the Accuracy of their Medical Records

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## Abstract

**Objectives:** Assess (1) if patients can improve their medical records' accuracy if effectively engaged using a networked Personal Health Record; (2) workflow efficiency and reliability for receiving and processing patient feedback; and (3) patient feedback's impact on medical record accuracy.

**Background:** Improving medical record' accuracy and associated challenges have been documented extensively. Providing patients with useful access to their records through information technology gives them new opportunities to improve their records' accuracy and completeness. A new approach supporting online contributions to their medication lists by patients of Geisinger Health Systems, an online patient-engagement advocate, revealed this can be done successfully.

In late 2011, Geisinger launched an online process for patients to provide electronic feedback on their medication lists' accuracy before a doctor visit. Patient feedback was routed to a Geisinger pharmacist, who reviewed it and followed up with the patient before changing the medication list shared by the patient and the clinicians.

**Methods:** The evaluation employed mixed methods and consisted of patient focus groups (users, nonusers, and partial users of the feedback form), semi structured interviews with providers and pharmacists, user observations with patients, and quantitative analysis of patient feedback data and pharmacists' medication reconciliation logs.

**Findings/Discussion:** (1) Patients were eager to provide feedback on their medications and saw numerous advantages. Thirty percent of patient feedback forms (457 of 1,500) were completed and submitted to Geisinger. Patients requested changes to the shared medication lists in 89 percent of cases (369 of 414 forms). These included frequency- or dosage changes to existing prescriptions and requests for new medications (prescriptions and over-the counter). (2) Patients provided useful and accurate online feedback. In a subsample of 107 forms, pharmacists responded positively to 68 percent of patient requests for medication list changes. (3) Processing patient feedback will requires both software algorithms and human interpretation. For the 107 forms subsample, pharmacists accepted patient input in 51 percent of cases where they could not contact the patient. Where the patient was contacted, they accepted feedback from 68 percent. This suggests there may be opportunities to automate feedback filtering and processing for more efficient (and larger scale) medication-list optimization. (4) A supportive overall e-health environment makes acceptance of an online patient feedback system more likely. Review of Geisinger usage data showed patients who completed the medication feedback form had previously accessed MyGeisinger 2.3 times as often as the average patient and initiated secure messages with a clinician 1.35 times as often as patients not involved in the pilot.

**Conclusions:** Patient feedback, placed in a useful workflow, can improve medical record accuracy. Electronic health record (EHR) vendors and developers need to build appropriate capabilities into applications. Continued research and development is needed for enabling health care organizations to elicit and process patient information most effectively.

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**Keywords**

electronic medical records, data quality, patient engagement

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# How Patients Can Improve the Accuracy of Their Medical Records

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## ABSTRACT

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## CONT'D

online feedback. In a subsample of 107 forms, pharmacists responded positively to 68 percent of patient requests for medication list changes. (3) Processing patient feedback will require both software algorithms and human interpretation. For the 107 forms subsample, pharmacists accepted patient input in 51 percent of cases where they could not contact the patient. Where the patient was contacted, they accepted feedback from 68 percent. This suggests there may be opportunities to automate feedback filtering and processing for more efficient (and larger scale) medication-list optimization. (4) A supportive overall e-health environment makes acceptance of an online patient feedback system more likely. Review of Geisinger usage data showed patients who completed the medication feedback form had previously accessed MyGeisinger 2.3 times as often as the average patient and initiated secure messages with a clinician 1.35 times as often as patients not involved in the pilot.

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### Introduction

With the widespread adoption of electronic health records (EHRs) and progress with health information exchanges (HIE), providers will more readily exchange medical information about their patients with other providers, and patients will have more opportunities to engage with their clinical teams about their medical conditions. While the goal of these interactions is to improve continuity of care and patient safety, when patients access their medical information they are likely to have questions, identify inaccuracies, or have information that may have an impact on their health records data. Incorporating these patient contributions has the potential to improve the quality and safety of patient care by creating a feedback loop between patients and their multiple providers.

### Background

The literature points to data quality problems in health records, both paper and electronic. Medication lists, in particular, have been identified as a source of low-quality data that can lead to medication errors.<sup>1,2,3,4</sup> For example, a recent review of studies of data quality reported medication lists omission rates of between 27 percent for ambulatory oncology patients<sup>5</sup> and 53 percent for primary care patients.<sup>6</sup> 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.<sup>7</sup> Errors because of retention of discontinued medications were common while incorrect medication regimens were less common.<sup>8</sup> In a survey of patient concerns about emergency departments, patients identified



medication errors as one of the most experienced error-rated concerns.<sup>9</sup> Other surveys have shown that approximately 75 percent of survey respondents would be concerned about medication errors if they were hospitalized.<sup>10</sup> Standard reconciliation practice includes asking what medications a patient is taking, asking about allergies, as well as asking about symptoms.

Patients want to participate and believe that they have the potential to help reduce medical errors. In 2003, researchers conducted interviews with 2,078 patients regarding their attitudes about and participation in medical error prevention. Ninety-one percent of participants agreed (35 percent strongly agreed) that patients could help prevent errors. In addition, 98 percent of participants agreed (51 percent strongly agreed) that health care organizations should even educate patients on error prevention.<sup>11</sup> In another study, when asked to choose which of 14 recommended actions to protect against errors would be the most effective and most likely for consumers to engage in, survey respondents chose “Making sure all of your doctors know about every prescription medicine you are taking” as the second highest in perceived effectiveness and also one of the most likely actions they would take.

Patients’ willingness to ensure that their providers have accurate knowledge of their medications was reported in the 2008 Kaiser Family Foundation’s survey of consumer concerns. The findings from this survey note that 59 percent of respondents reported that they have brought a list of all the medications they are taking, including over-the-counter (OTC) drugs, to their provider appointment. This percentage has increased from previous surveys, 54 percent in 2006 and 48 percent in 2004.<sup>12</sup> A 2010 national survey by the California Healthcare Foundation found that “making sure that information is correct” is the personal health record feature most commonly cited as useful by the public.<sup>13</sup> A 2010

Markle Foundation survey finds similar agreement between patients and providers on the need for a correction process. Seventy-seven percent of patients and 76 percent of doctors agreed with the statement that patients should “have a clear process to request corrections or dispute the way their information is handled.” This is an increase from previous years, as only 52 percent of patients reported interest in a corrections process in 2008.

Patient willingness to be involved in data correction and their desire for a transparent process represents an important advancement in public awareness, as well as an opportunity to meet a growing demand with innovative solutions that provide widespread benefit to the general public. A comment from one patient reflected this interest:

“Just recently I got a visit summary from an encounter with my PCP, and I read it (as most people would). I found 3 significant errors: A problem I didn’t have, a procedure I hadn’t had, and a medication I wasn’t taking. I called to report the problem, and no one even knew how to route my call. On day 2, call #3, I got hold of the office manager. She understood the issues, but her hands were tied. There was no policy about how to handle my request to address these needed changes. She said she would take care of them, but we agreed that was not a scalable solution.”

While patients believe they can contribute, analyses show that patients’ ability to communicate accurately to their health care providers about their medications is not perfect.<sup>14,15,16</sup> Indeed, the Institute of Medicine (IOM) analysis of health information technology (HIT) and patient safety identifies the “reliability of data entered by patients, families, friends or unauthorized users” as the most common safety concern of patient engagement tools.<sup>17</sup> In order to increase the safety of patient engagement, a better understanding of the risks

of patient feedback must also be assessed. Similar analyses have proved useful in interventions such as Computerized Physician Order Entry (CPOE).<sup>18,19</sup>

As data systems mature and electronic health record (EHR) adoption becomes more widespread, the question becomes how to effectively capture the burgeoning flow of data for secondary uses and to identify EHRs' role in cultivating a learning health care system. Ensuring good data quality at the outset is critical to realizing this vision. The IOM's vision of a learning health system is that, "activities involving measurement, comparison, evaluation, systematic introduction of accepted therapies, sharing of experience and information, and coordination of these activities among organizations either are, or should become, normal expected activities."<sup>20</sup> These activities include traditional research as well as quality reporting and improvement programs, and use of particular guidelines and applications informing patient and provider decisions.<sup>21</sup>

Electronic platforms, such as personal health records and patient portals, that allow patients to view their records, submit and receive comments, and request changes increase the ease, speed, and potentially the frequency of this process. Many health systems, such as Geisinger, have created online portals for patients to access their "consumer EHRs," which allow them to view lab results and trend data, refill prescriptions, communicate securely with providers, obtain educational content, and create self- and clinical reminders.<sup>22</sup> HIT has been similarly leveraged by health systems to address medication adherence and engage patients, and will continue to grow in importance. Organizations are using patient portals to gather patient feedback and correct medication lists and other types of data.<sup>23</sup>

HIE is expected to further expand these benefits and efficiencies, especially given Stages 2 and

3 of meaningful use (MU). With the increase in community and regional health information organizations (HIOs), there are new opportunities for patients to access their medical information from these data intermediaries instead of going to each of their providers. In many cases, HIOs aggregate patient data from different sources and offer a more comprehensive view of the patient's medical record.

Some HIOs are also beginning to expand their services to consumers by giving them access to a personal health records and patient portal through which they can access and view their medical information from different community providers. These HIOs have the potential to facilitate how patient feedback is received and triaged, and how necessary changes can be propagated to community providers. Community HIE initiatives create new ways for patients to access and review their medical information and opportunities for patients to improve the quality of information in their medical records.

The Centers for Medicare & Medicaid Services (CMS) is seeking solutions empowering patients to review and request changes to their medical records, an acknowledgement of the potential role patients can play in quality control. Patient engagement is one of the five policy priorities under MU. While Stage 1 MU focused on giving patients access to their medical information, Stages 2 and 3 are increasingly focused on empowering patients to use the data. Stage 2 requires providers to support patients' ability to electronically view, download, and transmit their medical information.<sup>24</sup>

Stage 3 will potentially further empower patients; the Health IT Policy Committee has settled on an MU Stage 3 objective for eligible professionals and eligible hospitals to "receive provider requested, electronically submitted patient generated health information."<sup>25,26</sup> Online patient medication feedback



is one example of an area where providers can request feedback from patients. Inclusion of patient-feedback requirements in Stage 3 MU will serve as an important lever for a broader communitywide impact of patient-feedback mechanisms.

Finally, efforts to employ software to empower and engage patients parallel the efforts to assist consumers and citizens to improve data quality, build trust in systems, and resolve problems in other contexts. In the e-commerce space, for example, eBay resolves 60 million disputes a year using software-facilitated negotiation,<sup>27</sup> and efforts are ongoing to assist consumers who wish to correct errors in credit reports. The fields of patient engagement and online dispute resolution<sup>28</sup> may be distinct in many ways but they share a concern over individuals who may suffer if their voices are not heard.<sup>29</sup>

### Overview of the Geisinger Pilot

Geisinger Health System is a physician-led, not-for-profit, integrated delivery system developing innovative products and services designed to provide high-value care. Geisinger serves an area with approximately 2.6 million people in northeastern and central Pennsylvania. Geisinger's annual patient volume exceeds 40,000 inpatient discharges and 1.5 million outpatient visits, and the system employs more than 900 physicians in 50 practice sites, including 40 community practice clinics.

Geisinger completed installation of its outpatient EHR in 2002 and its inpatient EHR in 2008, using the system across all of its practice sites. The system, which also incorporates decision support, now contains more than 3 million patient records. More than 200,000 patients use Geisinger's networked personal health record (PHR), called "MyGeisinger," for health information, appointment scheduling, prescription ordering, checking lab results, and secure messaging with clinicians.

In November 2011, Geisinger initiated a medication feedback pilot at two rural primary-care clinic sites (Berwick and Pottsville, Pennsylvania) as part of its broader medication reconciliation effort. The goals of the feedback pilot were threefold: (1) Assess if patients can be effectively engaged using a networked PHR; (2) Assess the efficiency and reliability of a workflow for receiving and processing patient feedback data; and (3) Assess the impact of patient feedback on the accuracy of the medical record. There were two inclusion criteria for the study:

1. Patients have specific chronic conditions (i.e., chronic obstructive pulmonary disease, asthma, hypertension, diabetes, or heart failure). An ever increasing number of Americans in all age groups live with chronic diseases that require complex care and management. The pilot study targeted five common and costly chronic diseases: chronic obstructive pulmonary disease (COPD) and asthma (34.8 million Americans), diabetes (20.9 million), heart disease (22.5 million), and hypertension (55.1 million). An Agency for Healthcare Research and Quality (AHRQ) brief named these diseases among the top 10 most costly to the health care system, based on the MEPS-HC survey.<sup>30</sup> Although these chronic conditions affect people of all ages, a disproportionately large number are over age 65, require complex care for their health needs, and are members of vulnerable populations.<sup>31</sup> A 2010 survey found that 5 percent of Medicare beneficiaries have asthma, 12 percent have COPD, 28 percent have diabetes, 31 percent have heart disease, and 58 percent have hypertension, and that these rates increase among beneficiaries also enrolled in Medicaid (dually eligible beneficiaries). Even among nonelderly Medicaid beneficiaries, the most common diseases were diabetes (9 percent), cardiovascular disease (28 percent), and respiratory diseases (23 percent).<sup>32</sup>

2. Patients are active PHR users—meaning patients who have logged into MyGeisinger at least once—who have at least one scheduled upcoming appointment with their primary-care physician.

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

1. Patients were sent an electronic link to a medication feedback form, prepopulated with their current active-medication list according to their EHR record. Patients had the option of indicating which medications they were no longer taking, which they were taking differently from the way the instructions were presented, and medications they were taking that were not listed.
2. Patient responses were routed to a Geisinger pharmacist who reviewed the patient's input and attempted to follow up with the patient.
3. Following the pharmacist review and patient contact (when possible), the pharmacist

updated the medication record and notified the patient's physician and case manager (when one had been assigned) about any changes by completing a note in the EHR.

Table 1 describes aims and research questions.

## 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 on the usability and usefulness of the form. In addition, we conducted semistructured discussions with the pharmacists and providers participating in the pilot study on topics such as the usefulness and scalability of the form.

**Table 1. Aims and Research Questions**

AIMS	KEY RESEARCH QUESTIONS
<p><b>Goal 1: Determine if patients can be engaged to improve the quality of information in medical records</b></p>	<ul style="list-style-type: none"> <li>• Will patients be engaged to provide feedback?</li> <li>• Will patients provide feedback?</li> <li>• What factors influence whether patients provide feedback?</li> </ul>
<p><b>Goal 2: Assess processes for obtaining and processing patient-generated feedback</b></p>	<ul style="list-style-type: none"> <li>• If and how should patient feedback be triaged?</li> <li>• What processes are needed to process patient feedback?</li> <li>• What processes are needed to make updates and amendments to the medical record?</li> </ul>
<p><b>Goal 3: Assess impact of the patient feedback</b></p>	<ul style="list-style-type: none"> <li>• How accurate is the feedback?</li> <li>• What is the impact of patient feedback on providers and patients?</li> <li>• Does patient feedback contribute to more up-to-date and accurate records?</li> </ul>



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; and
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.

Analysis of the qualitative discussions informed the quantitative analysis and interpretation, and together provide further avenues of research to be explored

with more comprehensive data. Table 2 identifies the key quantitative measures for this pilot study.

### Study Limitations

**Methodological limitations.** First, time and resource constraints did not permit comparison with a control group of patients who were nonusers of MyGeisinger. This was a limited pilot study to assess if patients can be engaged online and whether the information that patients provide regarding their medication lists is accurate. At the time of the pilot study, the authors were not able to identify any other studies of a similar nature in the literature. We therefore note that while limited in scope, the pilot provides new findings on the innovative use of consumer online tools to improve medication list accuracy.

Further research is needed in different community settings and using control groups to develop a knowledge base on the impact of patient feedback about the accuracy of medication lists. For example,

**Table 2. Key Measures**

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 MyGeisinger and preference for its usage

in future studies in-office correction rates could be collected for a control group while portal users' data could also be collected. If the portal users arm of the study finds far more corrections, then we can add demonstrable efficacy to the list of benefits on online feedback tools.

Second, findings from the medication feedback study were from only one institution, and since a limited number of pharmacists and physicians were involved in the pilot, qualitative findings may not be broadly generalizable to all Geisinger pharmacists and physicians.

**Data source issues.** Since the patient-form data file is based on two sources, the EHR and survey questionnaire software, there may be unidentified issues in the data integration process. In addition 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's action (if any). As a result of these issues, the accuracy of the data and, therefore, of the analysis, is dependent on how well the data mining process was understood by the researchers.

**Analytic limitations.** 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 who were nonactive users of MyGeisinger (i.e., registered users who received but did not submit the medication feedback form). We recognize there may be additional insights to be gathered from these patients.

### Opportunities for Future Studies

The pilot study did not explore potential solutions and processes that would prevent medication mismatches in the first place. Future studies could assess qualitatively the changes that were

made and how many of those mistakes were preventable through better communication, counseling about the purpose of medications, or other process improvements. Future studies should also incorporate attitude surveys before and after the intervention to assess (1) whether provider expectations match patient expectations, and (2) how well those expectations match what actually happens.

## Results

We begin by discussing key qualitative findings from the patient focus groups and user (provider, pharmacist) observations. Discussion of the quantitative results follows, including patient submitted forms and pharmacist medication reconciliation logs.

### Analysis of Focus Group Responses and User Observations

Most participants were long-time users of MyGeisinger, with some reporting they signed up for portal access when it launched in 2002. Among focus group participants, MyGeisinger usage varied from twice a week to once a month. Many patients described using MyGeisinger to schedule appointments, refill prescriptions, review test results, track medications, learn about procedures and 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 saw benefits in having medication feedback available online. The benefits include convenience of electronic access, enhanced ability to track and monitor medications for themselves and 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 liked bringing a printed copy of the form to office visits to reduce the time spent on medication reconciliation so they could address other concerns with the physician. Many focus group participants reported that having a prepopulated medication form was convenient to review. As noted by one patient, “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.”

Patients reported feeling more informed about their health care and were more confident when asking questions about medications during office visits. A few 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.

Patient feedback on their medications is clinically significant. Several patients indicated they take various OTC medications, vitamins, and supplements. These medications were not included on their medication lists initially so they had to add them when 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. For example, one patient noted, “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 also reported finding discontinued medications still listed as active current medications and differences in the frequency with which they were currently taking medications relative to what was listed on MyGeisinger.

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 participants noted that having specialized feedback forms for different parts of the medical record would be helpful. One participant suggested that Geisinger develop condition-specific tools that, in addition to collecting patient feedback, facilitate data submission by patients.

Pharmacists report that patient feedback has improved the accuracy of the medication list and were surprised by patient interest and responsiveness to providing information on their medications. Both pharmacists indicated that patients were diligent in reporting OTC medications and adding drugs prescribed by physicians outside of Geisinger. Patients also updated dosages and reported medications 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 their 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 on the form without any errors. Anecdotally, the pharmacists reported that in 80 percent of cases, patient feedback was accepted and resulted in changes to the medication record.

The medication feedback form has improved patient engagement, communication, and information sharing. Both pharmacists and physicians reported the form prompted patients to thoroughly review

their medications. During office visits, some patients discussed with their physicians how they reviewed their medications at home and they shared a printed copy of the form. The form offered patients an opportunity to let providers 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. Another physician reported he spends less time reconciling medications with patients who complete and bring a printed copy of the form to their visits. The time it takes to complete medication reconciliation depends on the number of medications, and can vary from 1 to 2 minutes to 15 minutes. When medication reconciliation is completed, or at least attempted, prior to the office visit, the efficiencies can be considerable. For example, one provider reported spending half the usual amount of time on medication reconciliation, which is a huge time savings given that doctors often have only 15 minutes per patient.

Similarly, both pharmacists noted that 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.

### Analysis of Patient Feedback Data

Geisinger has approximately 3 million patient records in their EHR system. Across Geisinger's 40 patient clinics, they have approximately 225,000 patients using Geisinger's networked PHR. Between November 2011 and June 2012, Geisinger sent out a sample of 1,500 feedback forms to patients in 2 clinics. The sample was selected from patients

that met two criteria: patients with specific chronic conditions (i.e., COPD, asthma, hypertension, diabetes, or heart failure) and active users of MyGeisinger. Geisinger received 457 completed forms for a response rate of 30 percent.

A sample size of 414 responses were included in the analysis. Forty-three responses were removed either because they came from patients who were less than 18 or greater than 90 years old or because they 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 Geisinger experienced in prepopulating the medication feedback forms sent to patients.

*Patient Demographics.* Figure 1 shows the age distribution of patients who completed the feedback form. When combined, patients in the age groups of 46 to 55 and 56 to 65 years old account for almost 60 percent of the population.

### Volume and Nature of Patient Feedback

Patient medication feedback data were segmented into three categories: (1) Feedback received on medications that were on the Geisinger prepopulated medication list (which can include both prescription and OTC medications); (2) Feedback received on prescription medications the patients said they were taking that were missing from the Geisinger prepopulated medication list; and (3) Feedback received on OTC medications the patients said they were taking that were missing from the Geisinger prepopulated medication list.

*Patients requested changes in the majority of medication feedback forms submitted.* Of the total 414 patient feedback forms, patients requested



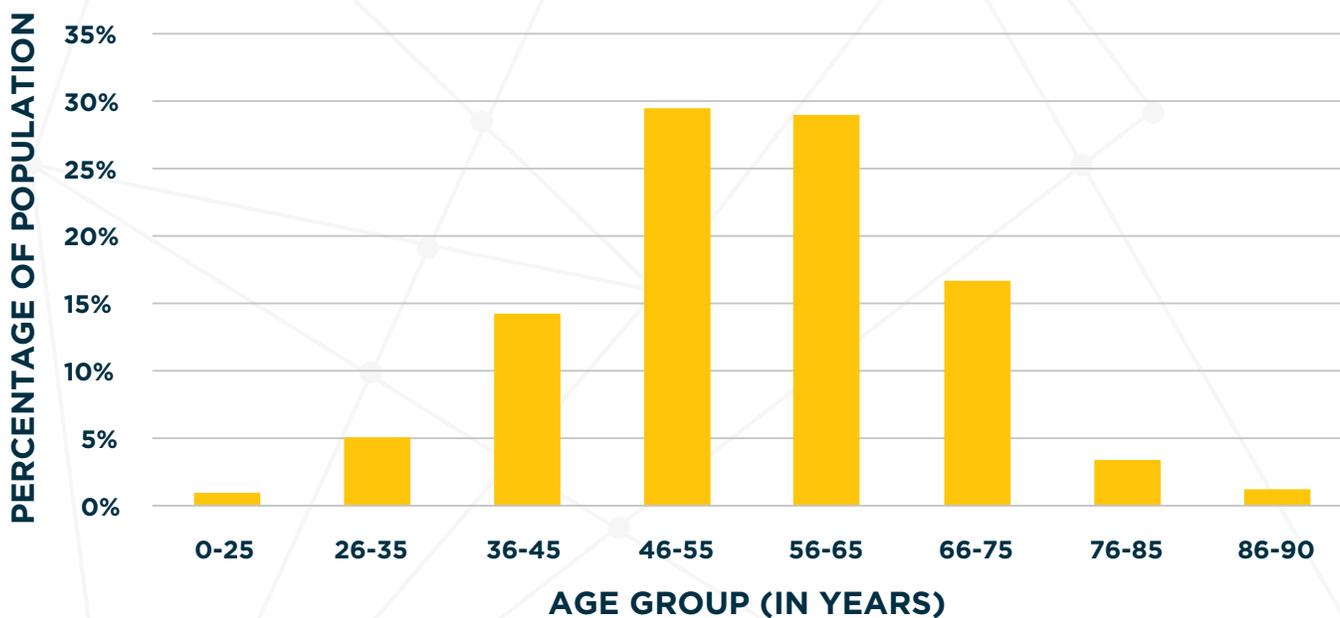
changes to their medication list in 369 forms (89 percent of submitted forms) (see Table 3). Patient-requested changes include all three categories.

In the analysis of patient feedback forms in category 1 (feedback received on medications that were on the prepopulated medication list), patients identified discontinuations or changes in frequency or dosage on 281 submitted forms (67.9 percent). 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 requesting any changes.

In the analysis of patient feedback forms in category 2 (feedback received on prescription medications missing from the prepopulated medication list), patients listed additional prescription medications on 82 submitted forms (20 percent). The 82 forms

**Figure 1. Age Group Distribution of Patients Who Completed the Feedback Form**



Source: Patient feedback forms collected November 2011-June 2012

**Table 3. 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 November 2011-June 2012

included a total of 141 requested additions to the Geisinger medication list, for an average of 1.7 requested additions per patient form.

In the analysis of patient feedback forms in category 3 (feedback received on OTC medications missing from the prepopulated medication list), patients listed additional OTC medications on 257 submitted forms. Since multiple OTC 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. A study of a subsample of 107 forms submitted April 17, 2012–June 11, 2012 ], found 65 forms where patients requested documentation of new OTC medications. The number of additions requested totaled 178 for an average of 2.7 per form.

#### Analysis of Pharmacist Medication Reconciliation Logs

In order to assess the validity of patient responses (i.e., 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 (April 17, 2012–June 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) We chose the last completed responses, as this represented the most stable view of the data.

Preliminary analysis of data shortly after the pilot was initiated revealed inconsistencies in how pharmacist responses were coded. We worked closely with the Geisinger team on coding patient medication entries into categories 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).

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

Based on the analysis of the pharmacist logs, we came to several key conclusions, described below.

***Patients can provide accurate and valid feedback on their medication list.*** 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 subsample analysis does not include any requests patients made for documentation of new medications (prescriptions or OTC medications), these counts represent an undercounting of data accuracy improvements that are likely to result from online patient feedback.

***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 all "active" users of MyGeisinger (See Table 5). Patients in the pilot who submitted the medication form log on to MyGeisinger more than twice as often on average than do patients who are not part of the pilot study (63 logins per year for patients who submitted the medication feedback form compared to 27 logins 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 do other active users of MyGeisinger (10.2 secure messages initiated per year for patients who submitted the medication feedback form compared



Table 4. Patient Feedback Forms Categorized by Pharmacist's Actions

SCENARIOS	PATIENT REQUEST			PHARMACIST ACTION	
	NUMBER OF PATIENT FORMS	NUMBER OF FORMS IN WHICH PATIENTS REPORTED DISCONTINUATIONS, OR CHANGES IN FREQUENCY OR DOSAGE	NUMBER OF MEDICATION ENTRIES PATIENTS REQUESTED BE REMOVED OR CHANGED	NUMBER OF FORMS PHARMACIST ACCEPTED FOR CHANGES	NUMBER OF MEDICATIONS CHANGED BY PHARMACIST BASED ON PATIENT FEEDBACK
Patient saw PCP prior to pharmacist's review	9	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 April 17, 2012–June 11, 2012 and pharmacist medication reconciliation logs

Table 5. MyGeisinger Usage Rates Annualized for 2012

USAGE MEASURES	DESCRIPTION	ANNUAL RATES
Logins by all active users	Average number of logins to MyGeisinger	27
Logins by active users who submitted the medication feedback form	Average number of logins 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)

to 7.6 secure messages initiated for patients who were not included in the study).

Answers to the medication-feedback forms survey support this conclusion. Figure 2 shows that 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.

## Discussion

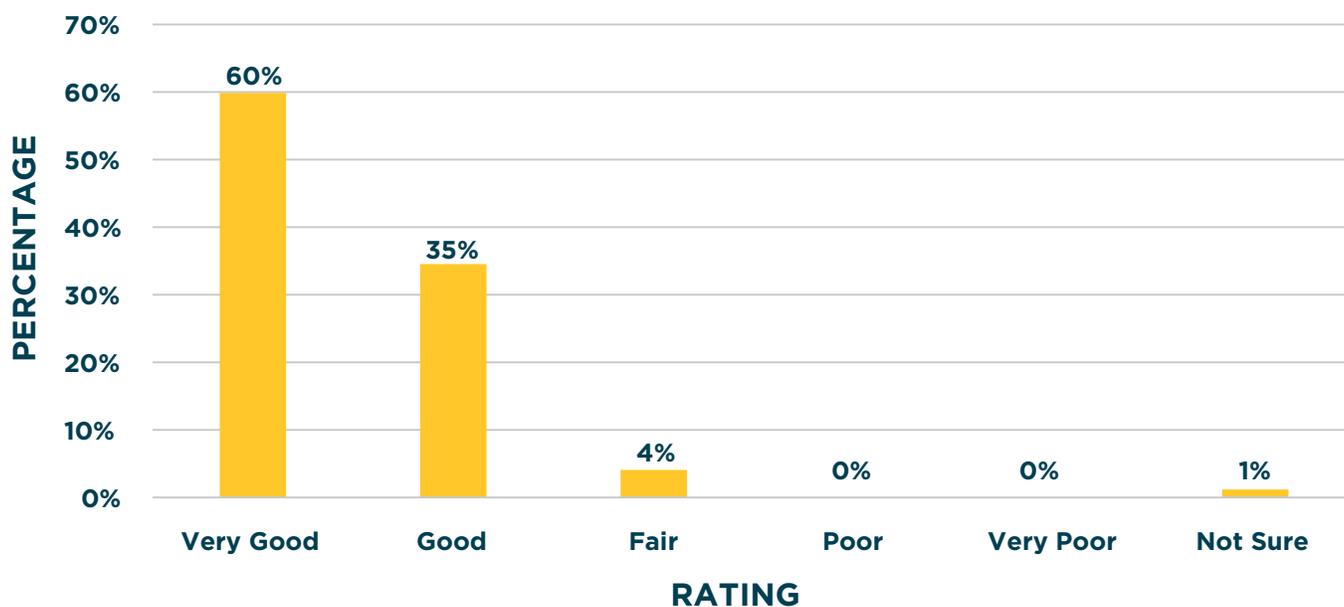
We have gleaned many insights from the Geisinger pilot regarding how patients can be engaged to provide feedback and how to organize care processes that support patient feedback and maximize reliability of the information provided by patients. Below we summarize the most salient findings.

*Patients are eager to provide feedback on their medication list and see numerous advantages.*

Quantitative data showed 30 percent (457 of 1,500) of medication feedback forms were completed with 61 percent (281 of 457) of those requesting discontinuations or changes in frequency or in dosage for the medications stored in their EHR, and 62 percent (284 of 457) presenting new medications. Cumulatively, 89 percent (369 of 414 submitted forms) were requests for changes to the medication record.

Patient focus-group findings suggest that most patients find that online access to their medication lists and the 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. Initial comparisons also suggest that medication

**Figure 2. Patient Responses to the Question “Overall, what is your opinion of MyGeisinger?”**



Source: Patient Feedback Forms (November 2011–June 2012)



reconciliation is more thorough when done at home versus in a provider office.

***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 (26 of 39) of changes when they could contact them. 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. Patient willingness and their ability to provide useful and accurate information suggest that patients may be uniquely suited to contribute to the quality of their medical records, and online tools can facilitate this process.

***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. 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, when practiced 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, other changes could proceed without, or with minimal, human intervention.

Furthermore, using structured form fields to capture information would facilitate the processing of patient feedback. In subsequent similar studies, we recommend using structured fields for OTC medications. This would improve the quality of feedback received as patients would not have to manually enter all the OTC medications and subsequent analysis would be facilitated by the capture of structured data. Based on the initial pilot findings, Geisinger has expanded the medication feedback system to 10 primary care clinics. Currently, Geisinger reports processing 300 completed medication feedback forms every month across the 10 clinic sites. To scale the intervention, Geisinger has implemented 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.

Specifically, Geisinger has introduced a triage system, which divides patient feedback automatically into three categories. The forms with changes in prescriptions are sent to pharmacists as before. The forms with the least risky feedback, e.g., those indicating no changes are necessary or those that only indicate new OTC medications, are automatically accepted. The remaining forms are sent to the patient's primary care physician's office for processing. There may be further opportunities

to automate processes by applying decision support rules on different classes of drugs and these are currently under consideration at Geisinger.

***Acceptance of online patient feedback system is more likely to work because of an existing supportive overall e-health and 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 indicate 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 and 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 on to MyGeisinger 2.3 times the average (63 versus 27) and initiate secure messages 1.35 times as often (10.2 versus 7.6).

***Software can facilitate the Health Insurance Portability and Accountability Act (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 process, and more one of collaboration between patients and providers than of 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, 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.

***Communitywide application of patient-directed electronic health record (EHR) data curation.*** The pilot study was conducted in two of Geisinger's primary care clinics. While we recognize that the clinics benefit from the infrastructure of Geisinger's larger integrated delivery system, this pilot provides valuable insights on how this intervention can be used in other community settings. Its application to other settings is particularly relevant as a number of communities are contemplating opportunities related to Accountable Care Organizations and strategies around how care delivery models can be modified to improve patient safety and outcomes.



First, the pilot identified meaningful ways to engage patients with their online medical records and factors that influence patient participation. Patient engagement objectives in Stages 2 and 3 of MU are driving the health care system toward greater interaction between patients and providers via online tools. The Geisinger pilot provides insights on how to create a supportive online environment (MyGeisinger) and make functions available (e.g., medication reconciliation) that are of value to patients.

Second, while the study was limited to medication feedback, other immediate areas identified by patients, providers, and industry experts for patient feedback include problem lists, immunizations, and allergies. Third, the pilot demonstrated how an integrated care delivery team involving the patients and their caregivers, primary care providers, and pharmacists can create efficiencies around the process of medication reconciliation with the patient at the center. These efficiencies stem from shortening the time devoted to medication reconciliation during office visits and consequently freeing up provider time for other important patient interactions.

***Potential impact of patient-directed personal health record (PHR)-mediated method to increase data quality in a larger community context.*** Geisinger uses an integrated medical record, shared across all of their delivery sites. Many community settings do not have the benefit of such an integrated record; however, the growth of community HIE solutions may offer new opportunities to build a comprehensive view of patient information across providers in spite of different EHR platforms.

Such interventions have the potential for communitywide impact by enhancing the accuracy of data for communitywide clinical measures and population health management. While the

initial Geisinger pilot looked at medications only, patients and providers saw benefit to expanding patient feedback to other areas of the medical record, notably medical allergies, immunizations, patient and family medical histories, and smoking cessation. By ensuring that patients can review and provide feedback on, for example, immunizations, providers will be able to contribute more data to state immunization registries. State public health departments will benefit from having more complete, accurate, and up-to-date accounts of immunization records as they plan and implement their public health programs.

## 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. They also provide valuable insights into effective strategies for gathering and processing patient feedback, and showcase the opportunity for EHRs to assist in maintaining accurate and complete medical records. Furthermore, the data show that patients are eager to provide feedback and that the information they provide is likely to improve the accuracy of their records.

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. In addition, the Geisinger pilot highlights 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; methods to efficiently automate appropriate aspects of form processing, and to measure the impact on physician office workflow; and studies assessing outcomes related to cost, patient quality, and safety.

Based on this successful pilot, Geisinger has expanded the feedback mechanism to all 10 primary

care clinics. Additionally, medication allergies have been added to the form. Currently Geisinger receives an average of 300 completed patient-feedback forms every month from the 10 clinics. Geisinger notes the triage systems they have established to process patient feedback is working well based on anecdotal feedback from providers and pharmacists.

Data quality of EHRs is important, and not just for the individual patients involved. As data from EHRs are extracted and flow into epidemiological reports and other Big Data findings, the accuracy of the source data is vital. The value of the data can be enhanced by the “millions of free fact checkers,”<sup>33</sup> patients who can monitor their records before doctor visits, and indeed at any time that is convenient. It is important that EHR vendors and developers provide the necessary functionality and that health providers encourage users to contribute to this important data quality effort.

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