Title: Medication Reconciliation: Bridging Communications Across the Continuum of Care

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Structured Abstract:
Purpose: This project was designed to develop and test an interdisciplinary medication reconciliation process to improve documentation and transfer of medication lists across the continuum of care.
Scope: The new process was developed and implemented in a community health system in Portland, Oregon, consisting of five hospitals and a medical group of primary care and specialty clinics.
Methods: An interdisciplinary group developed the process utilizing our electronic medical record and implemented it throughout the health system. The group developed training materials for all disciplines involved and collected data regarding medication discrepancies before and after the new system was in place. The group also collected data on adverse drug event rates and patient, staff, and physician satisfaction.
Results: The number of medication discrepancies between the patient medication list and the admission orders decreased from 1 to 0.6 per patient. The number of discrepancies at discharge decreased from 2 to 1.7. Both of these were statistically significant. The two smaller community hospitals showed the biggest improvement, whereas the larger tertiary care hospitals had similar rates before and after the intervention. The number of adverse drug events decreased after the intervention. Patients felt the new system provided more information in an easy-to-understand format. Physicians and staff adapted well to the new system and provided pertinent feedback to improve the process at key points in implementation.
Key Findings: Medication reconciliation is a process that touches on all aspects of healthcare and requires input and cooperation from an interdisciplinary team to be successful. To accomplish the process effectively, increased nursing and/or pharmacy resources are needed, and physician buy-in is crucial Involving the medical staff and senior leadership early in the process increases the chances of success. Current electronic medical records often require significant upgrades and modifications to successfully implement the process.

Purpose:

The overall purpose of this project was to develop and test an interdisciplinary medication reconciliation process that resulted in accurate documentation and information transfer of medication lists across the continuum of care, with the primary goals of reducing adverse drug events and improving patient outcomes.

The study aimed to answer the following questions:

1. Can adverse drug events for inpatients be reduced through the consistent application of a medication reconciliation process?
2. Can medication adherence rates among patients seen in the outpatient setting following hospitalization be increased through the use of a reconciled medication list?
3. What criteria comprise a best-practice model to trigger pharmacist review of patient medications and allergies?
4. Does medication reconciliation result in decreased ED admits and/or re-hospitalization of patients?

The project included four aims:
AIM 1. Test a functional interdisciplinary medication assessment model through the development of a systemwide process to create, maintain, and update a complete list of medications and allergies at the time of admittance to any primary care service along the continuum of outpatient primary care and inpatient care.
AIM 2. Use Adverse Drug Event (ADE) trigger analysis research and the Hepler/Strand Pharmaceutical Care Model to develop objective criteria for requiring pharmacist review of medication lists in the inpatient and outpatient settings. Describe the impact of a consultative medication review process on pharmacy and other resource needs.
AIM 3. Develop and test processes that ensure communication of medication and allergy lists to all external providers and the patient upon transfer of care or discharge.
AIM 4. Develop, refine, and disseminate a toolkit for implementing medication reconciliation in a multitiered health system.

Background: The Joint Commission has implemented Patient Safety Goals that incorporate improved medication safety for hospitals across the country. A component of improving safety involves accurately and completely reconciling medications for patients at all points of entry and transitions in the healthcare system. Improving this process could influence the number of adverse drug events that patients experience inside the hospital and when they leave the hospital.

Context: Legacy Health System's process for obtaining a medication history before implementation of this project was indicative of many systems across the country in that it relied on data collected in varying ways by multiple people and documented in multiple places in the medical record. In addition, although we utilize an EMR for much of the nursing documentation, physicians still utilize a paper chart for ordering and documentation, creating a hybrid patient record. Some departments are completely paper based at this time due to limitations of the EMR.

This project created a standard process and location for the medication information that was accessible to everyone involved with the patient at all points of contact in the health system. It utilized the medication module in our existing electronic medical record (EMR) to capture and share the data. New processes and reports were created in our EMR to assist in data collection and capture. Before implementation of this project, medication errors were the leading patient safety event within Legacy. Medication errors are reported through a combination of the online self-reporting mechanism and incident reports, which are submitted via an online intranet application. During its FY06, LHS documented 2,646 reported medication errors. Of these, 1,812 medication errors (68%) were classified as significant (attributable to therapy omission, wrong dose, wrong drug, wrong patient, or extra dose administered). Failure to consistently apply established procedures contributed to 20% of these errors.

Settings: Legacy Health System is the largest not-for-profit healthcare system based in Oregon. Legacy provides an integrated network of healthcare services, including acute and critical care, inpatient and outpatient treatment, community health education, and a variety of specialty services.

Legacy Health System (LHS) was formed in 1989 by the merger of Good Samaritan Hospital and Medical Center and HealthLink. LHS facilities include:

- Two tertiary hospitals: Legacy Good Samaritan Hospital & Medical Center (GS) and Legacy Emanuel Hospital & Health Center, a Level-1 Trauma Center (EH)
- Three suburban, community hospitals: Legacy Meridian Park Hospital (MP), Legacy Mount Hood Medical Center (MH), and Legacy Salmon Creek Hospital (SC)
- The largest children's hospital in Oregon: Legacy Emanuel Children's Hospital (ECH)
- The Oregon Burn Center, serving all severe burn patients from Seattle to San Francisco
- A full-service research facility: Legacy Clinical Research & Technology Center
- Legacy Clinics, a group of primary and specialty care physician practices that serves patients of all socioeconomic classes in the urban and suburban Portland, Oregon, and Vancouver, Washington, metropolitan areas
- Legacy Hopewell House: a 14-bed acute care hospice

Legacy offers a full range of tertiary care services at sites throughout Northwest Oregon. Comprehensive programs and services are available in many clinical areas, including cancer, heart, rehabilitation, geriatrics, and women's services.

Salmon Creek Hospital, which opened in August 2005, was not at full capacity until a year into the project and was excluded from many data analyses. It utilizes a different EMR than the other hospitals in the system. Other sites are transitioning to this EMR over the next few years. All data analyses refer to the four other hospitals listed above. Specific data that are attributable to Salmon Creek will be so designated.

Participants: All Legacy facilities, clinical staff, medical staff, and patients were involved in implementation of the new system. The primary implementation team is listed above. IRB approval was obtained prior to beginning the study.

Prevalence: The prevalence of adverse drug events was 0.004% in FY06. There were 2,646 events documented in 659,589 admissions.

Methods

Study Design: This project utilized both qualitative and quantitative data to identify and substantiate success factors important to creating an interdisciplinary medication reconciliation process and system across the continuum of care. The work was conducted in a large multihospital health system with both urban and suburban campuses as well as both primary care clinics and specialty clinics over a 2-year period.

An interdisciplinary project steering team was developed and included individuals from Quality, Pharmacy, Information Resources (IR), Health Information, Medical Staff, and Nursing. Subgroups were initially developed to carry out specific tasks. These included a Standards and Policies group, a Quality Assurance/Outcomes group, and an Information Resources group. Of the three groups, only the Standards and Policies group continued throughout the project. It was determined early on that the work of the other two subgroups could be done within the Steering Committee more efficiently and effectively. A similar interdisciplinary workgroup was created at SC to adapt the process for their EMR. The project manager and lead pharmacist on the project attended both groups to ensure consistency in the processes.

The Steering Committee created the process for medication reconciliation using our EMR and flow-charted the idealized process for all clinical areas involved. A Failure Modes and Effect Analysis identified that staff not completing their part of the process due to lack of time was the most commonly identified failure mode. Other important identified failure modes included hospital culture, physician buy-in, and the complexity of the EMR. During implementation, various strategies to address the modes were utilized, including addition or reallocation of staff to assist with the process. The Steering Committee also held meetings with senior leadership to outline potential resource needs going forward to address these concerns.

The Standards and Policies subgroup composed of representatives from Nursing, Health Information, Quality, Pharmacy, and IR created the training plan for the nurses, physicians, and pharmacists. It also made decisions regarding changes to the medication

module that required nursing input. All their recommendations were reviewed by the Steering Committee before adoption.

The major IR project required before implementation of the process was editing of the menus and medications in the medication module of the EMR. This work began early in the project and continued throughout the first year. It included making the medication selection lists more user friendly and creating standard defaults for listing of the medications in the module to help address the EMR complexity failure mode.

In the new process, the nurses gathered the medication information from the patient, entered it into the medication module, and printed out the medication list for the physician to review. A nursing learning module was created and used in a 2-hour classroom-based training session for those staff members identified by their managers as superusers. It included an evaluation form, post test, and competency checklist in addition to the learning materials and was taught by members of the Steering Committee. In the first hour, the learning module was reviewed; in the second hour, staff practiced the medication reconciliation process under the supervision of the Steering Committee members. All other staff not identified as superusers received a paper version of the learning module to complete. They then worked with a superuser on their unit to enter their first patient into the system using the new method. In all, 900 nurse superusers received classroom training. Twenty-seven hundred nurses received the learning module.

Physician training involved an initial notification letter of the new process and then direct contact by a member of the Steering Committee to schedule training. All physicians received a physician-specific education packet outlining the new method and their role. The physicians were to review the paper report at admission and reconcile the home medications with their inpatient orders. At discharge, the physician went into the electronic medication module and updated the list. They then notified the nurse, who printed the report for the patient and next provider of care. Hands-on training was given to those physicians and physician groups that requested it. Approximately 100 physicians throughout the system received hands-on training out of a total medical staff of 2,000.

Pharmacists received learning materials specific to their role in the process and group trainings by members of the Steering Committee. Pharmacists reviewed the reconciled list in context of the inpatient orders and documented that reconciliation was complete in the EMR. Eighty-five pharmacists were trained.

Other requirements for the new process included providing a dedicated printer drawer for prescription paper on each unit. This allowed physicians to print prescriptions on the unit at discharge, improving legibility for patients. One of the other benefits of using the EMR medication module was that physicians could also fax prescriptions electronically to pharmacies directly.

The clinics implemented a similar process in 2007. The same process was utilized with clinic-specific learning modules. A specific clinic-based workgroup was created to

address areas of difference in the process from the hospital system. However, because the clinics had much greater a priori experience with the medication module, specific learning sessions were not done. Individualized teaching was done within the clinics on the new process as needed.

Evidence-based pharmacy triggers for high-risk medications and patients were identified with input from staff across the hospitals. The triggers were approved and incorporated into the medication reconciliation process and were to be used to identify patients that needed pharmacy review and intervention. However, due to limited pharmacy resources and the volume of consults, there were not enough pharmacy resources to meet the needs of the requested consults. Therefore, implementation of the pharmacy triggers was put on hold, pending the addition of pharmacy resources.

Communicating to the next provider of care at hospital discharge was accomplished differently at each site. At GS, MH, and MP, the nursing units were responsible for communicating the list of medications to the next provider of care. EH and ECH took a different approach to this communication process. Their Health Information department sent the lists to the next provider. Health Information utilized nursing students to help in this task initially. Each day, the staff printed a list of patients who were discharged and then printed the medication lists and faxed them to the primary care physician. SC adopted this method as well.

In parallel to our work, Legacy was involved with a regional medication reconciliation group consisting of all the major health systems in the metropolitan area. This group created a consistent medication card and form that patients could use at any system in the area. Each health system agreed to use the form and card to allow ease of collecting information from patients that utilized multiple systems. At Legacy, we provided a blank copy of the card and form to patients as an additional aid at discharge.

Data Sources/Collection/Measures:
Quantitative data were derived from automated mechanisms for medication error detection through existing reporting mechanisms, including pharmacy-generated ADE reports; self-reported medication errors communicated using the Legacy intranet application; and incident reports. The number of admissions with ADE diagnoses and whether the ADE occurred preadmission or during the hospitalization were also evaluated. Qualitative data were derived from formal and informal interviews; focus groups; and observation and self-reporting by patients, staff, and physicians. Process evaluation included chart reviews at the beginning of the project to establish a baseline rate of errors/medication discrepancies and a follow-up chart review at the end to assess improvement. Together, the quantitative and qualitative data were used to attempt to establish the degree of error reduction and improvement in patient safety, enhancements in patient outcomes, and increases in patient and provider satisfaction that were attributable to the new process.

1. Chart review: A retrospective review of 45 charts from every unit of every hospital was done for the period of January through March 2005 to determine baseline rates of error. A follow up was done for the period of April through June

2007 to evaluate changes in the error rates after full implementation. Charts were chosen from all discharges on the units using a random number system. Categories of error included number of medication discrepancies on admission and discharge overall and by hospital as well as the total number of errors for the system. Medication discrepancies were defined by reviewing any home medication list in the chart and determining whether each medication was continued during the hospitalization. If it was not, whether there was documentation of why the medication was held was noted. If that documentation was not easily found, a discrepancy was coded. The data were analyzed using a two-tailed, two-sample t test looking for significance at $p<0.05$.

2. ADE Report: Initially, these data were collected in several reports. However, all adverse drug event data, including errors detected related to medication reconciliation, were consolidated into one report during the study period, and that report was reviewed and analyzed by one of our clinical pharmacists. The report outlined what percent of the ADEs was preventable and whether they were the cause of the hospitalization. It also outlined whether the ADE happened before or during the hospitalization. The data were analyzed using chi-squared methodology looking for significance at $p<0.05$.
3. Monthly compliance reports: This report summarizes the compliance with medication reconciliation at admission and transfer for each hospital. It compares the number of times the process is completed appropriately versus the total number of admissions/transfers for the month. We are currently unable to assess compliance at discharge for all sites and transfer compliance at SC due to system limitations. Data were analyzed using the Fisher exact test looking for significance at $p<0.05$.
4. Unit audits: Each hospital unit has the opportunity to do hand audits of each step in the process to determine where they need to focus their resources to improve compliance. Each unit that chooses to perform these site-specific audits performs a chart review of each step of the process for 30 charts per month. Audit forms have been created for both inpatient units and outpatient areas. Up to this point, the data have not been collected systemwide, as the audits were specifically designed for the units to improve their processes. We recently have begun entering these audits into our quality system to allow a more systematic evaluation of the data.
5. Admission Report: A comparison of diagnoses specifically related to medication adverse events of all types was performed to determine the rate of change of adverse medication event diagnoses before and after implementation of the process. The data was analyzed using chi-squared methodology looking for significance at $p<0.05$.
6. Patient Satisfaction data:
    a. Patient focus group: A patient focus group was arranged for patients who had been recently discharged from the hospital to assess patients' awareness of and satisfaction with the new process. However, despite repeated attempts, patients did not attend the groups. We then performed surveys on patients who were attending cardiac rehabilitation programs at several hospitals to assess their knowledge and satisfaction with the process.

b. Clinic survey: The Legacy Clinics implemented medication reconciliation toward the end of the grant period. An initial survey of patient satisfaction with the process was performed early in the implementation to assist with further implementation.

7. Physician/Staff satisfaction data:
    a. Focus groups: Several focus groups were held at the sites after implementation to assess staff satisfaction and elicit feedback. These were variably attended but yielded significant feedback that was incorporated into the process and reports, including reformatting of the reports and clarification of the process and enhancement of the learning modules.
    b. Anecdotal information: Interested staff and physicians provided ongoing feedback to the Steering Committee throughout the project. Specific suggestions for improvement were reviewed by the Steering Committee and incorporated into the process as deemed appropriate and feasible.

Intervention:

1. EMR changes/enhancements: The medication module changes have been discussed above. In addition, reports were developed to assist in the process at admission and discharge. The admission home medication list was a printed version of the list in the medication module that the physician could use as an order form in conjunction with their admission orders. The discharge reports included one printed list that indicated which medications the patient should be taking when they go home and one that listed any home medications that were discontinued while in the hospital and they should not take at home. A report to assist with transfer was also created, but its usage was limited mainly to patients transferring out of the intensive care unit. This report was used in conjunction with the admission home medication list to ensure that home medications held during a stay in the intensive care unit were restarted once the patient was more stable.
2. Pilots: Small pilots of the new process were done early in the project at two hospitals to assess resource needs and determine areas of breakdown in the process. The staff involved determined that the new process didn't take much more time than the existing one unless the patient was on more than 10 medications, that there needed to be more attention to hand-offs for the next shift by nursing, and that there was difficulty getting information from retail pharmacies due to HIPAA concerns. The first large-scale pilot test of the new medication reconciliation process took place on a busy medicine unit that also served as the main unit for patients with renal disease, diabetes, and status-post-renal transplant. The average number of medications for patients on this unit was 15. The Steering Committee provided support to the staff from 7 am until 9 pm during the first week of the pilot. The pilot unit continued to use the new process after the initial pilot period ended due to its success, despite concerns about the time needed to gather and document the information. Feedback by staff and physicians on the unit allowed further refining of the reports.
3. Full implementation:

a. Starting in July 2006, all the hospitals rolled out the new process, with the last site going live in December 2006. This was approximately 6 months later than planned. The same learning modules and methods of support were employed at each site. In addition to the learning materials, cheat sheets were created for each discipline to provide a quick reference as needed. These one-page cheat/instruction sheets were placed strategically on each unit. All materials, including the cheat sheets and the learning modules, were compiled and placed into binders that were given to each unit as a reference following implementation. Meridian Park Hospital and Mount Hood Medical Center required less hands-on support by the Steering Committee the first week of their implementations due to their size and their ability to designate additional internal support.
b. SC was a unique implementation in that they utilized a different EMR than the other Legacy hospitals, as noted above. At the time of their medication reconciliation implementation, they had only recently been trained on the new EMR. The changes to accommodate the new process were minor, so the need for additional training was not great, and the IR implementation team provided the necessary training. As with the other hospitals, learning materials and cheat sheets were created and placed in notebooks for reference on each unit.
c. Emanuel Hospital hired approximately 20 fourth-year nursing students to assist with initial implementation and assist in the first 6 months in order to help provide support in its high-volume areas. Those individuals were placed in strategic areas, including the Emergency Department, Day Surgery, and Pediatric Acute Care, to assist in the process.
d. An interesting difference in the MP implementation was their approach to missing medication information. The pharmacy chose to actively review medication lists and clarify missing information. Once the missing information was gathered, they updated the medication module. This helped with the amount of work that the physicians needed to do at discharge to finalize the discharge list.

Limitations

1. Pharmacy triggers: As noted above, although our pharmacy triggers were created and tested and found to be useful, implementation of the pharmacy triggers was put on hold pending the addition of pharmacy resources.
2. Implementation: The initial implementation plan included rolling out the new process to all sites within the first 12 months of the project to allow a year of follow-up data collection. However, due to complications in instituting needed changes in the EMR (noted below), full implementation at all sites did not finish until 18 months into the project period, with most of the sites implementing the process in months 12-18. This limited our ability to collect data and trend improvements over time.
3. Emergency Department (ED): The emergency department utilizes an electronic charting system that interfaces with our EMR but has key areas of nonintegration. This has inhibited full implementation of the process in the ED

due to the need for the physicians to document medications in both systems. This has created a corresponding lack of compliance with the process. In addition, the ED physicians' group took responsibility for training their physicians at three of the sites. This was not as successful as we had hoped. Trainings did not take place in advance of implementation at those sites. This caused delays during implementation.

4. EMR limitations: Our current EMR has a steep learning curve to use and is not always intuitive. In addition, we are transitioning from one EMR to another, which has stretched our Information Resources department as they try to maintain, upgrade, and support two EMRs at the same time. Needed enhancements and changes to the EMR often took longer than expected and required more complex programming than initially anticipated. This created delays in full implementation and the creation of workarounds that continue to slow the process down.
5. Staff limitations: Several departments do not utilize the EMR at this time, including diagnostics, short stay, and day surgery, due to system limitations. This necessitated adapting the process to allow them to accomplish medication reconciliation in those areas. For several, implementing medication reconciliation required new staffing, new hardware, and a large change in workflow.
6. Training:
    a. Initially, our resource nurses were not included in any formal medication reconciliation trainings due to scheduling issues. They all received copies of the learning module to review but did not attend any classes. These nurses did eventually receive classroom training. However, because they float to a number of sites and work variable hours, they often do not receive timely information about changes and improvements to the process. This has reduced their ability to utilize the new system effectively. We are continuing to evaluate effective ways to train this group. All new nurses receive training on the process during their orientation.
    b. The nurses who attended the 2-hour trainings were designated as superusers on their units and were to provide assistance to their colleagues as needed. They were also able to sign off on the post-test/competency checklists for their coworkers. However, some of the superusers did not feel comfortable enough with the process after the classroom training to provide the necessary level of support to their coworkers. Continued education and support by the Steering Committee was required to assist the superusers.

Principal Findings/Outcomes:

1. Chart Review
    a. The number of medication discrepancies on admission and discharge improved after implementation of the new system. On admission, the mean number of errors was reduced from a mean of 0.95 ± 1.78 discrepancies per patient prior to implementation of the process to 0.60

± 1.62 discrepancies per patient after implementation. This was statistically significant ($p<0.0001$) (Figure 1). At discharge, there was a similar improvement in medication discrepancies, with the mean improving from 2.07 ± 3.07 per patient to 1.72 ± 3.46 per patient. This again was statistically significant ($p=0.035$) (Figure 2).

Figure 1: Total medication errors at admission

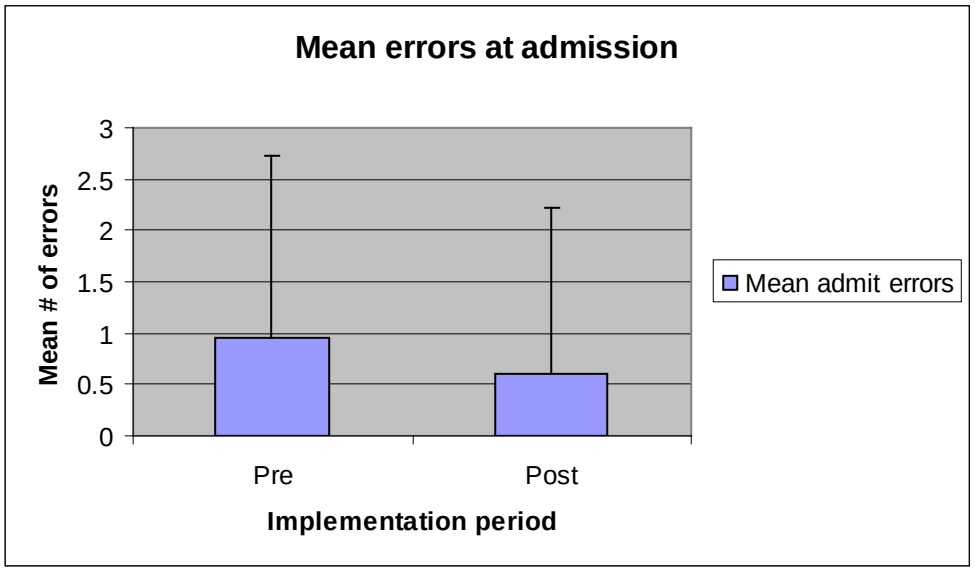
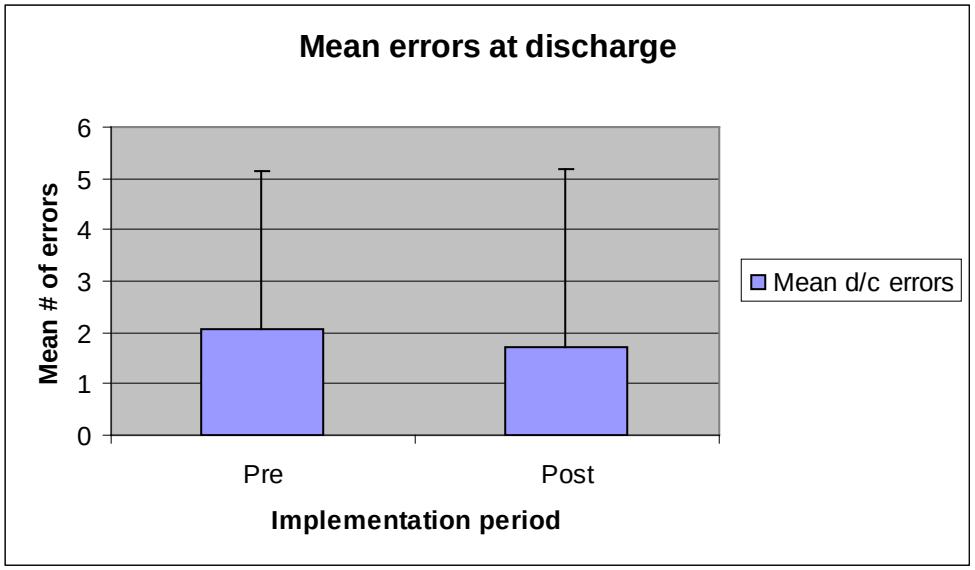


Figure 2: Total medication errors at discharge



b. We also looked at the number of medication discrepancies at admission and discharge by hospital to evaluate site variation. MP had a statistically significant improvement in the number of discrepancies on admission before and after implementation. Before implementation, their mean was 1.47 ± 0.15; afterward, it was 0.45

± 0.14 ($p<0.0001$). Though other sites improved, none was statistically significant (Figure 3). At discharge, both MH and MP demonstrated significant improvement. MP improved from a mean of 2.10 ± 0.26 to 0.84 ± 0.29 ($p<0.0069$), and MH improved from a mean of 2.36 ± 0.26 to 0.80 ± 0.29 ($p< 0.00026$). GS appeared to trend toward slight worsening but, on closer evaluation, it was not determined to be a statistically significant difference (Figure 4).

Figure 3: Medication discrepancies at admission for each hospital

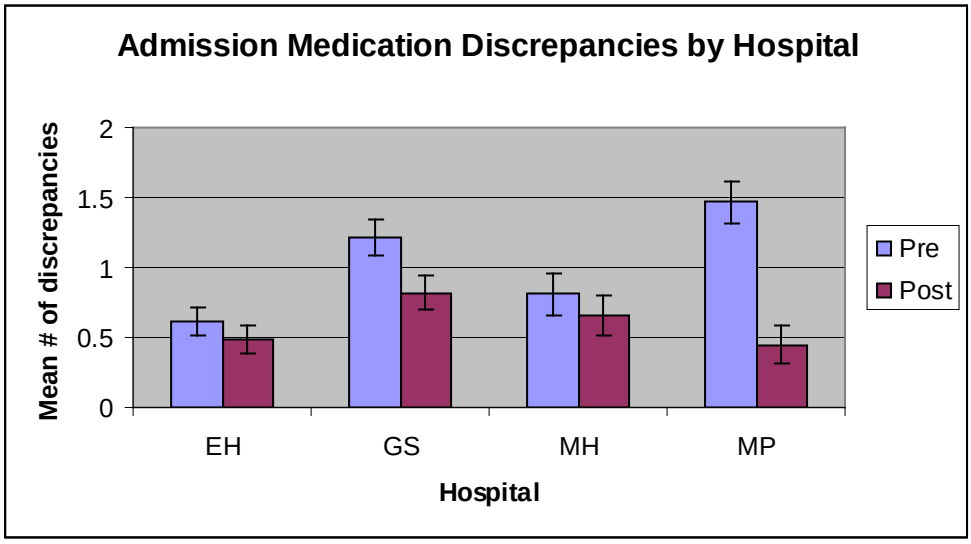
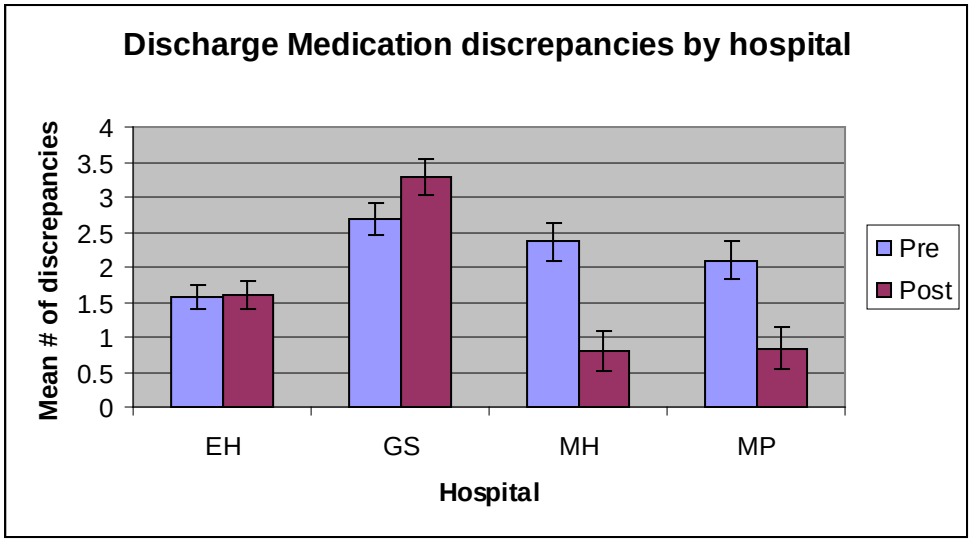


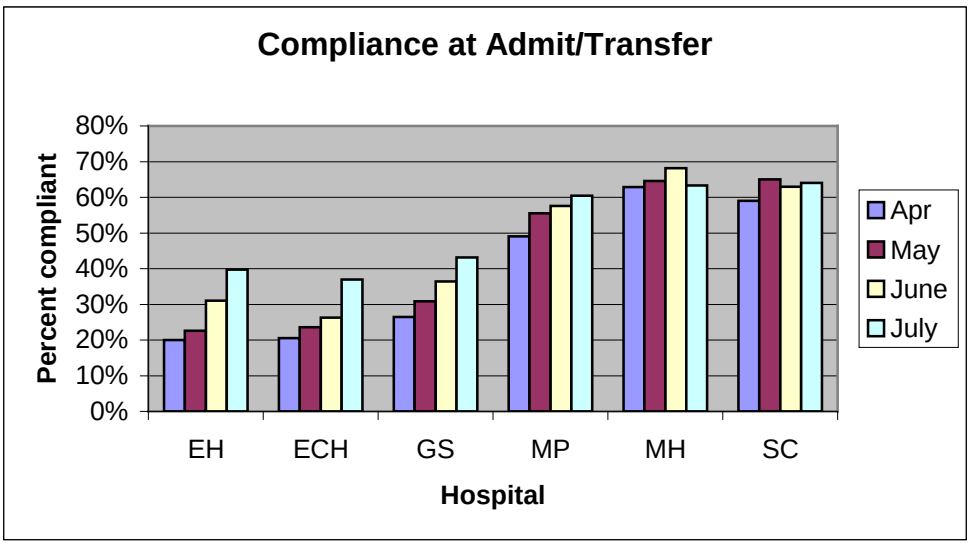
Figure 4: Medication discrepancies at discharge for each hospital



c. The total number of medication errors improved after the intervention as well. Before implementation, the mean number of med errors was 3.03 ± 4.08 per patient; afterward, it was 2.32 ± 4.01. This again was statistically significant ($p=0.0009$).

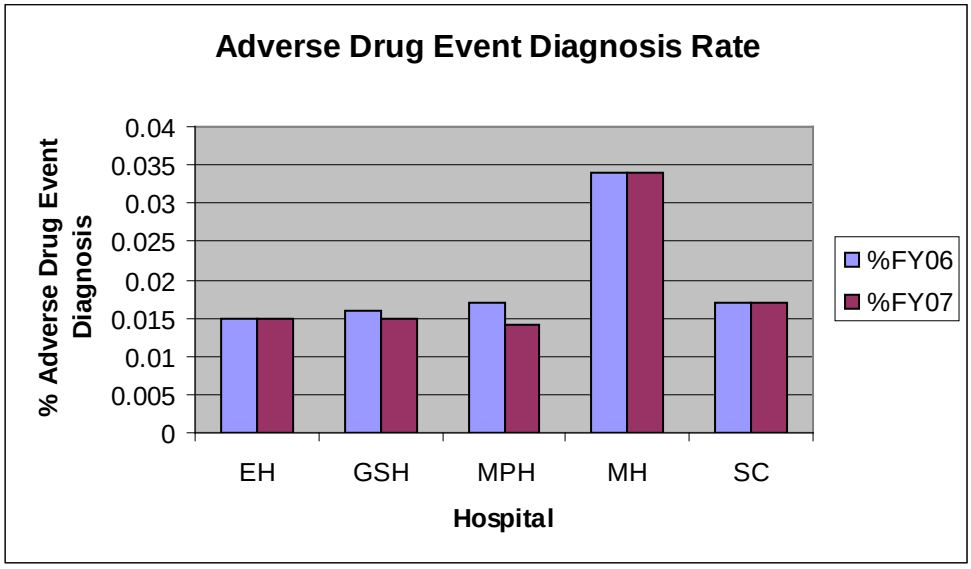
2. ADE Report: The total number of ADEs decreased from 1.6% to 1.4% of total discharges in the system. This was statistically significant (p=0.0009). The number of preventable ADEs did not change (p=0.94), but the number of ADEs that caused hospitalization decreased from 1.0% to 0.9% (p=0.014) .The number of ADEs that occurred prehospitalization also decreased from 1.0% to 0.9% (p=0.04).
3. Monthly compliance reports: All sites had fully implemented the new process by December 2006. Compliance was spotty initially. We reviewed data from April-July 2007 to evaluate improvement. As expected, the hospitals as a whole significantly improved (p=0.0035) (Figure 5).

Figure 5: Compliance with medication reconciliation process at admission and transfer for each hospital



4. Admission Report: We evaluated whether the process made a significant change in the number of patients diagnosed with a medication error. The hospitals were significantly different from each other (p<0.000001), but the intervention did not make a significant improvement in the number patients with ADE diagnoses (p=0.2). The lack of improvement may be a function of the limited time of full implementation (Figure 6).

Figure 6: Percent of patients with an ADE diagnosis at discharge



5. Patient Satisfaction data: Anecdotal comments from patients indicate that the process has been seen as a positive step.
   a. Cardiac Rehabilitation data: Results from the patient surveys were consistently positive. Patients felt that the new process provided a list of medications at discharge that is clear, is easy to read and understand, and gave them valuable information.
   b. Clinic Survey: A survey of the clinics was done 2 months after full implementation There was a 39% response rate across all the clinics (N=1,752). Ninety-three percent of patients stated that their healthcare provider had reviewed their medication list with them, 84% thought the review was helpful, and 90% received a copy of their list to take home.
6. Discharge medication list communication: Compliance with forwarding the list of medications to the next provider of care from the inpatient setting is low. There is not a consistent electronic tracking system in place, and currently there is no place for staff to document this in the EMR, so the staff are documenting in the paper record. Additionally, there is not currently an electronic way to document that a list was given to the patient at discharge and verify exactly what was on the list. To ensure accurate documentation, two copies of each list print when the list is requested. One copy is given to the patient, and the other is placed in the paper record for future review as needed.
7. Time/Staff Utilization: Based on nurse feedback, utilizing the new process has added approximately 15-60 minutes to each admission, depending upon the complexity of the patient's medication list. This additional time has prevented staff from performing other important functions of their job at times. Review of the pharmacy trigger data demonstrated that, on average, there were 13 requests for a pharmacy

consult daily per hospital while it was being tracked, and virtually none of them was done due to resource limitations.

Discussion/Conclusions: This project utilized an existing EMR to facilitate medication reconciliation throughout a multi-hospital and clinic system. Medication reconciliation is a complex task that requires input and cooperation from an interdisciplinary team that includes nursing, physicians, pharmacy, and patients to accomplish successfully. Current healthcare processes often create barriers to performing effective medication reconciliation due to the disjointed systems that have been created over time. At Legacy Health System, the process of implementing a medication reconciliation system exposed other system processes that were not performing well. For example, requiring the nurses to input the medication list in a scripted way revealed that the medication lists put into the medical record in the past were often inaccurate and were based on what the patient had been taking in a prior hospitalization. This implementation also revealed that nursing staff were enabling physicians to avoid using the EMR by printing information on the unit so that the physician didn't need to access the EMR. The project highlighted limitations of our EMR to accomplish medication reconciliation but also revealed that electronic tools do not solve human system issues in patient care workflow.

However, the project also revealed that healthcare workers strive to provide high-quality care for patients and that a systematic method for obtaining medication histories can reduce medication discrepancies. The project also reminded us that new processes need to be integrated into the hospital culture to be successful and that incremental improvement is important. Staff ownership and buy-in into the process are critical for success, and providing appropriate resources is crucial. The project team provided systemwide and site-specific leadership during the project period, and many on the project team continue to be system leaders around medication reconciliation going forward.

The results here follow the usual healthcare model of demonstrating improvement in process measures long before documenting improvement in hard outcomes. The lack of significant improvement in admissions and adverse drug events is not surprising, given the short time the process has been in place; however, the continued improvement in compliance with the process is a positive sign that the culture is changing, which should lead to better outcomes in the future. We did show a decrease in ADEs for inpatients during our project even with the incomplete adoption of the process, although we are unable to trace the improvement in ADEs directly back to medication reconciliation. Many system improvements were in process during this time and may have influenced the results. However, medication reconciliation was the largest systemwide change, so it likely had a strong effect on the improvement.

In this project, we were unable to achieve all our aims or answer all our hypotheses, although we did demonstrate significant success in several areas. The difficulty of implementing change and the competing demands that are present in a large organization resulted in the project team scaling back our goals during the project. We were unable to demonstrate a reduction in ED admits and rehospitalizations in the 6 months of full

implementation, although there were some trends toward improvement in the former. Because of limitations in our system, we were unable to evaluate if adherence rates improved in the outpatient setting, although we have early indications that patients react positively to the review in the clinic. We did create criteria for a pharmacist review but were unable to fully test and implement it due to resource limitations.

We tested an interdisciplinary model and created a systemwide process to perform medication reconciliation and created objective criteria for pharmacy review. We also described the impact of the process on resource needs. We have developed and are continuing to test processes to ensure communication of the medication list to all external providers. We also are disseminating a toolkit to assist others in implementing medication reconciliation across a complex healthcare system.

Significance: This project illustrated the complexity of implementing large-scale system change in an organization with multiple hospitals and clinics. It also revealed that appropriate system resources need to be invested in early and that physician buy-in is essential to implementing new processes. Medication reconciliation is an important area of patient safety that has ramifications far beyond its specific implementation or scope. Because of the complexity of the process, the ability of an organization to implement this process can be viewed as a barometer of a system's safety culture.

Implications: Based on the issues raised by this project, Legacy has implemented several changes in the past few months:

MH posted two jobs for pharmacy technicians and EH posted four pharmacy technician positions to provide support in the ED and on the units as needed. At MP, approximately two nursing positions have the primary responsibility in assisting in providing support in the ED. In addition, MP has posted a half-time pharmacy technician position to assist in completing incomplete medication lists. GS hired two pharmacists and two pharmacy technicians to provide medication oversight in the ED. Though not responsible for medication reconciliation per se, they do assist as needed.

Pharmacy has dedicated resources for ongoing maintenance of the medication module, and each hospital has designated a site superuser who will be a liaison to a new systemwide steering group. This group will provide ongoing oversight to the process and be a clearinghouse for issues that are raised by staff and physicians at the sites.

List of Publications, Products and Presentations:

Legacy Health System Website. Legacy Health System, Portland Oregon. June 2007. http://www.legacyhealth.org/body.cfm?id=1878&oTopID=1878&PLinkID=1133.
Scalese R. Track your med rec compliance on one page. HcPro Briefings on Patient Safety. 2007;8(7):1-2.

Medication Reconciliation across the continuum. AHRQ Annual Meeting. Bethesda, MD. September 2007.

Medication Reconciliation – Bridging Communications Across the Continuum of Care. Poster presentation at National Patient Safety Foundation Annual Congress. Washington, DC. May 2007.

Medication Reconciliation – A Physician's Perspective. American Society of Hospital Pharmacists Summer Meeting. Orlando, FL. June 2006.

Medication Information: A Community Working Together to Improve Communication. AHRQ Annual Patient Safety Conference. Washington, DC. June 2006.

Medication Reconciliation: Insights on Advanced Practices. Scottsdale Institute Patient Safety Interest Group Conference Call. March 2006.