Medication Reconciliation: Are We Meeting the Requirements?

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Abstract

- **Objective:** To evaluate 2 medication reconciliation processes used at an urban academic medical institution.
- **Methods:** Results from a prescriber-led medication reconciliation process developed in response to a Joint Commission (JCAHO) patient safety goal were compared with a nurse-led reconciliation process implemented prior to the JCAHO requirement. Discharge orders on inpatients from 2 surgical intensive care units (ICUs) were reviewed. We calculated the percentage of ICU discharge orders with a prescriber signature attesting that reconciliation was done that contained at least 1 medication error. We defined a medication error as when the prescriber changed the ICU discharge order based on the nurse-led medication reconciliation process.
- **Results:** The nurses reconciled discharge orders from 104 patients in the ICUs. Of 104 discharge orders, 44 (42%) had a prescriber sign as reconciling the compiled medication list with the discharge order, and of those, 23 (52%) had at least 1 medication error identified by the nurse-led reconciliation.
- **Conclusion:** While our institution-wide prescriber-led medication reconciliation process met the JCAHO requirement, it had limited effectiveness for preventing errors in 2 ICUs. Given the resources devoted to meeting the JCAHO patient safety goal regarding medication reconciliation and limited evidence regarding the effectiveness of broad implementation, this patient safety goal could be reconsidered.

Medication errors in health care are common and contribute to significant preventable morbidity, mortality, and increased cost of care. One strategy to reduce these errors is an intervention called medication reconciliation. Medication reconciliation is defined as the process whereby a prescriber considers previous medication therapy while formulating new orders for initiation following a transition in care. The goal of medication reconciliation is to ensure that patients receive appropriate medication therapy as they move through the care continuum. Medication reconciliation has become a national priority and is one of the National Patient Safety Goals established by the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), effective January 2006 [1]. To remain or become accredited by JCAHO, health care organizations must implement the recommendations that address these goals.

While reconciliation should be a continuous process, it is generally targeted at transitions of care, or when accountability for a patient’s care moves from 1 group of providers to another. This is because transition of care represents a significant opportunity for medication errors. U.S. Pharmacopeia’s MEDMARX (Rockville, MD) system found that of 2022 medication errors reported involving medication reconciliation, 66% occurred during transfer within the hospital, 33% at hospital admission, and 12% at hospital discharge (www.usp.org/patientSafety/newsletters/capsLink). Other studies have documented between 46% and 60% of medication errors occurring during admission, in hospital transfer, or discharge from a unit or hospital [2,3], with more recent studies corroborating this increased risk during transition of care [4,5]. In another study, 73% of postoperative patients admitted to an intensive care unit (ICU) had a medication discrepancy between the surgery and anesthesiology preoperative histories [6].

 Appropriately performed medication reconciliation has face validity and some empiric evidence for preventing medication errors at transition points of care [4,5,7–9]. However, the process varies widely among hospitals. There is little to no evidence regarding the relative effectiveness or efficiency of these various methods and the associated burden or costs of implementation.

Despite the national resources committed to these efforts, little is known about the effectiveness of implementing medication reconciliation on a broad scale. While the institution-wide medication reconciliation process at John Hopkins...
Hospital meets the JCAHO requirements, concern existed regarding how effective it actually was in preventing medication errors. We evaluated compliance and effectiveness of the institution-wide medication reconciliation process in 2 surgical ICUs at the Johns Hopkins Hospital.

The purpose of this paper is to describe 2 medication reconciliation processes used at an urban academic medical institution, one prescriber-led and the other nurse-led, to evaluate the effectiveness of both forms of medication reconciliation, and to discuss the policy implications of our findings.

Methods
JCAHO's mandate requires that hospitals “accurately and completely reconcile medications across the continuum of care” [1]. According to JCAHO, medication reconciliation should occur at every transition point in care when new medications are ordered or existing orders are rewritten. Transitions in care include changes in setting, service, practitioner, or level of care. JCAHO is not prescriptive in terms of implementation, stating that it is up to each organization to determine how this process takes place.

Institution-wide Prescriber-led Medication Reconciliation
Johns Hopkins Hospital implemented an institution-wide medication reconciliation process in January 2006. The multistep process begins with the completion of a “home medication list,” which contains a record of the patient's active medications prior to hospital admission. This list includes prescriptions, over-the-counter remedies, vitamins, and herbal therapies. The home medication list is most often completed by the nurse but may also be completed by the patient, physician, or pharmacist. The admitting physician reviews this list, makes changes to the list (as necessary) following a conversation with the patient, then signs the list to acknowledge that it was considered in the process of ordering the initial hospital therapeutic regimen. Upon transfer to another service or change in level of care, the physician accepting care of the patient signs a “transfer reconciliation form” to attest that the home medications and the medications received by the patient just prior to transfer were considered during the process of ordering the new therapeutic regimen. Finally, on discharge from the hospital, the discharging physician reviews the patients' home medications and the medications received by the patient just prior to discharge and signs a “discharge reconciliation form” to attest that these medications were considered in the process of ordering discharge medications. The institution-wide process implemented at Hopkins in response to the JCAHO recommendation appears to be typical of many institutions.

Nurse-Led Medication Reconciliation Process
In July 2001, prior to the establishment of the JCAHO goal and our institution-wide reconciliation process, a multi-disciplinary team of health care professionals in an adult surgical ICU at the Johns Hopkins Hospital found that 94% of patients had a medication error in ICU discharge orders [4,7]. We defined a medication error as when the physician changed a medication on discharge orders based on results from the nurse-led medication reconciliation. As part of the nurse-led medication reconciliation process, a discharge survey was completed for all patients admitted to the ICU. This survey included a list of all allergies, pre-hospital medications, medications ordered in the ICU and in discharge orders, and a reminder to ensure that prehospital antihypertensive medications were prescribed in discharge orders. The discharge survey was initiated by the admitting ICU nurse within 24 hours of ICU admission and completed by the charge nurse just prior to patient discharge from the ICU. If any discrepancies were identified between medications that the patient had received prior to transfer and medication orders at transfer, the nurse paged the patient's physician to correct the discrepancies.

To obtain the baseline data for this study, 2 research nurses audited about 10% of discharges per week for 2 weeks. The audit continued for 19 weeks after implementation of the nurse-led medication reconciliation process to evaluate its impact on frequency of medication errors. Medication errors were nearly eliminated in discharge orders by week 18 [4,7]. In addition, on average, nurses requested modification of 10 ICU discharge orders per week from week 21 to 48 with routine use of the discharge survey.

Current Study
In 2006, at the time the institution-wide physician-led reconciliation process was implemented, we conducted a prospective study in two 14-bed surgical ICUs. The SICU admits approximately 1100 patients annually and the Weinberg ICU (WICU) admits about 1300 annually. The SICU was conducted in the first 2 weeks of January 2006 and the WICU study from February to April 2006. The study population included all inpatients discharged from the ICU during the study periods that had a form in their medical record signed by the prescriber (physician or nurse practitioner) acknowledging reconciliation of all medications. The prescriber signature was used to evaluate compliance with the JCAHO patient safety goal. Data collected were de-identified to maintain patient confidentiality. The study was approved by the Johns Hopkins institutional review board.

During the study period, the nurse-led medication reconciliation process was continued for all patients discharged from the WICU and SICU alongside the prescriber-led reconciliation to determine the effectiveness of the latter
reconciliation process. We calculated the percentage of ICU discharge orders with at least 1 medication error identified by nurse-led medication reconciliation. As in our previous study, we defined a medication error as any change in the orders resulting from the nurse-led medication reconciliation process.

Results
The nurses reconciled discharge orders for 104 patients: 27 in the SICU and 77 in the WICU. Of 104 discharge orders, 44 (42%) had a prescriber sign as reconciling the compiled medication list with the discharge order; of those, 23 (52%) had at least 1 medication error identified by the nurse-led reconciliation.

In the SICU, 3 of 27 (11%) patient discharge orders had a prescriber sign as reconciling the compiled medication list with the discharge order, and of those, 1 had at least 1 medication error. In the WICU, 41 of 77 (53%) patient discharge orders had a prescriber sign as reconciling the compiled medication list with the discharge order, and of those, 22 (54%) had at least 1 medication error.

Discussion
The goal of medication reconciliation is to ensure that patients are receiving the appropriate pharmacologic therapy as they move through the continuum of care. We found that while our prescriber-led medication reconciliation process applied to WICU and SICU patients meets the JCAHO regulation, it has minimal impact in preventing medication errors as compared with the nurse-led medication reconciliation process. In this study, 54% of discharge orders in the WICU and 33% in the SICU had medication errors despite the presence of a prescriber signature attesting that reconciliation had been completed. Examples of discrepancies found in this study were missing antibiotics, no pain medications ordered, wrong dose of β blockers, and no inhalers ordered for a fragile asthmatic patient. Further, the types of errors identified by the nurse-led process represent only a subset of medication errors. For example, missed or duplicate medication orders were commonly identified but few dosing errors were identified (data not presented). It seems unlikely that physicians will be able to dedicate the time needed to rigorously review and reconcile orders at all transitions of care, and nurses will likely play a key role in identifying potential discrepancies in medication orders to help facilitate the prescriber’s final reconciliation of medications.

We recognize several limitations to our study. First, our definition of medication error is debatable. In designing our study, we recognize that the decision regarding the use, dose, and frequency of medications is subjective. As such, we allowed the prescribers to self-define an error. That is, if the information identified through medication reconciliation was important enough for them to change the order, it was considered a medication error. This is likely the least biased approach to defining an error. Second, our approach to medication reconciliation may differ from what other hospitals are doing to meet the JCAHO standard, or it may be less effective than what other hospitals are doing. However, in our discussion with 127 Michigan ICUs [10], we found that hospitals lacked clarity regarding how to implement medication reconciliation, none rigorously evaluated its effectiveness, and most used a process similar to the John Hopkins Hospital. Third, our sample size is small. However, performance is poor, suggesting that our estimates of effectiveness are relatively precise. Finally, we evaluated one component of the medication reconciliation process and cannot comment on the effectiveness of other components of the medication reconciliation process.

Research Needs and Policy Implications
While identifying patients receiving incorrect pharmacologic therapy is laudable and likely to improve patient safety, how best to accomplish this is uncertain. Research and experimentation is needed to gain this knowledge. Creating a national policy or regulation prematurely will likely stifle these pursuits as hospitals will be forced to focus efforts and resources on “meeting” the requirement.

To achieve the goal of reducing medication errors, medication reconciliation must be a rigorous and explicit process based on empiric evidence of effectiveness. To date, there is little to no national effort to evaluate the science of medication reconciliation. More research is needed to understand the effectiveness of various forms of medication reconciliation and to evaluate the cost-effectiveness of medication reconciliation compared with other safety interventions. It would be helpful to clearly articulate the goal(s) of medication reconciliation, the types of errors to be reduced, and a method to evaluate the effectiveness of the process prior to establishing a national policy.

Efforts to improve patient safety require significant resources from hospitals. Medication reconciliation could be viewed as an organization-level intervention designed to improve medication safety. Yet the level of evidence supporting its effectiveness is much lower than would be required to implement a national standard for a patient-level intervention, such as using β blockers in patients with acute myocardial infarction. This is ironic given that organization-level interventions require far more resources to implement than patient-level interventions. The patient safety community has not clearly articulated the level of evidence required for an intervention to become a national standard.

For these reasons, health care must balance the risks of waiting for evidence and implementing potentially ineffective interventions. This is not to say that interventions should not be implemented. Rather, we need to recognize
that the infrastructure for health care to deliver safe care is underdeveloped. Therefore, resources in the form of staff time, information technology, and data collection will need to be invested. Insurers, employers, and ultimately, society must determine the extent to which they are willing to pay for safe care.

One solution to accelerate the evidence-based process before intervening with a national policy would be to implement and evaluate interventions (like medication reconciliation) in a representative sample of hospitals and produce a refined evidence-based intervention as a national policy. Included with this approach would be an ongoing evaluation process to continuously retest its effectiveness. Although this approach will take resources, it is likely that these resources will be fewer than what hospitals are currently spending to implement potentially ineffective policies. To make an analogy to patient-level interventions, phase 1 and 2 studies of medication reconciliation were conducted, but there are no phase 3 studies and no plans for phase 4 or postmarketing surveillance. We have learned about the perils of omitting phase 4 studies.

In conclusion, the institution-wide prescriber-led medication reconciliation process designed to meet the JCAHO patient safety goal is minimally effective compared with the more intensive nurse-led medication reconciliation process. More research is needed to better understand the effectiveness and efficiency of various approaches to medication reconciliation. Given the resources devoted to meeting the JCAHO patient safety goal regarding medication reconciliation and the limited evidence regarding the effectiveness of this process, this patient safety goal should be reconsidered.

Once data are available, a more clearly articulated medication reconciliation process is needed and should include the goal(s), types of errors to be prevented, and a method to evaluate broad implementation of medication reconciliation.