Original Article

Pharmacy-Based Medication Reconciliation Program Utilizing Pharmacists and Technicians: A Process Improvement Initiative

Stephanie B. Smith, PharmD, BCPS,* and Michael D. Mango, PharmD, MBA†

Abstract

Background: Pharmacists and pharmacy technicians have an opportunity to impact the quality of the medication histories and improve patient safety by ensuring accurate medication lists are obtained and complete reconciliation has occurred with the admission medication orders by owning the admission medication reconciliation process.

Objective: To compare the quality of a pharmacy-based medication reconciliation program on admission utilizing pharmacists and technicians to the usual multidisciplinary process.

Methods: This was a retrospective chart review process improvement study at a 186-bed tertiary care inpatient facility. Primary outcomes included both the accuracy of pre-admission medications listed and the reconciliation of those medications with admission inpatient orders. Technicians obtained patient medication histories. Pharmacists checked the technician-obtained medication histories and ensured reconciliation of those medications with admission orders.

Results: Medication accuracy increased from 45.8% to 95% per patient ($P < .001$) and medication reconciliation increased from 44.2% to 92.8% ($P < .001$) and remained above benchmark.

Conclusion: A pharmacy-based medication reconciliation program utilizing both pharmacists and technicians significantly increased the accuracy and reconciliation of medications on admission. These gains were maintained for the duration of the 6-month period studied and beyond per continued process improvement data collection.

Key Words—admission, medication reconciliation, process improvement

Hosp Pharm—2013;48(2):112–119

In 2005, The Joint Commission (TJC) published National Patient Safety Goal 8 (NPSG), stating that medications should be accurately and completely reconciled across the continuum of care. TJC mandated that by January 2006, hospitals must have fully implemented a process of medication reconciliation.¹ The medication reconciliation process provides a seamless transition of medication records throughout admission and discharge from a health care system. A 2005 study illustrated that 54% of inpatient admissions had a minimum of 1 medication discrepancy between the patient's home medications and admission orders.² Of those discrepancies, 39% had the potential to cause moderate to severe harm.²

More simply stated, 20% of patients had at least 1 medication discrepancy on admission that could cause moderate to severe harm.

Two years after TJC mandated NPSG 8, hospitals were having difficulty meeting medication reconciliation requirements. During the first 6 months of 2008, 22% of hospitals were noncompliant with the requirement for obtaining accurate medication lists on hospital admission.³ TJC recognized the challenges hospitals encountered in meeting NPSG 8 and re-evaluated and refined the expectations of this important safety goal. In December 2010, the TJC approved its revised NPSG 8 with evaluating and scoring to begin on July 1, 2011.⁴ The process and results

*Pharmacy Clinical Coordinator, †Director of Pharmacy Services, Carolinas Medical Center Mercy, Charlotte, North Carolina. Corresponding author: Michael D. Mango, PharmD, MBA, Carolinas Medical Center Mercy, 2001 Vail Avenue, Charlotte, NC 28207; phone: 704-304-5859; e-mail: Mikedmango@comporium.net

Date _____ Ht _____ IN. Wt _____ lbs _____ kg
☐ Actual ☐ Stated ☐ Actual ☐ Stated See additional Medication Forms

Allergies: ☐ Denies ☐ Latex Sensitivity			
Meds/Foods/Dyes/Other	Reaction	Meds/Foods/Dyes/Other	Reaction

Information obtained from: ☐ Patient/Family ☐ Patient's Prior Records ☐ MAR from other facility ☐ Other: _____
☐ Pharmacy ☐ Medicine Bottles ☐ Records from other facility _____

Pharmacy Name: _____ Phone No: _____

Primary Care Provider: _____ Office location: _____

Medication disposition: ☐ no meds brought to hospital ☐ sent home ☐ other: _____

Order on Admission	HOME/PRE-ADMISSION MEDICATION/ DOSE/FREQUENCY (include conc. if liquid form; all routes are oral unless listed otherwise)	Date/ time of last dose prior to admission (“UNK” if unknown)	Comments and/or Explanation of Reconciliation	Continue at Discharge
	☐ Patient not taking any home medicines ☐ Patient unclear about home medications on entry ☐ Patient /Family advised to bring medications or medication list to facility			
Yes/No				Yes/No
Yes/No				Yes/No
Yes/No				Yes/No
Yes/No				Yes/No
Yes/No				Yes/No
Yes/No				Yes/No
Yes/No				Yes/No

History Taken By: _____ ☐ continued on page 2

Medications to be reconciled by MD prior to discharge. New/changed medications should be added to pg 2.

Medications Ordered (If “yes” or “no” circled on left above):			Scanned to Pharmacy (used as order) by:	
MD Signature:	Date:	Time:	Date:	Time:

Carolinas HealthCare System
MEDICATION RECONCILIATION FORM
 Admission and Discharge page 1

version 8-8-07

Patient Identifier

Figure 1. Carolinas Healthcare System medication reconciliation form.

See additional Medication Forms

Order on Admission	HOME/PRE-ADMISSION MEDICATION / DOSE/FREQUENCY <i>(include conc. if liquid form; all routes are oral unless listed otherwise)</i>	Date/ time of last dose prior to admission <i>("UNK" if unknown)</i>	Comments and/or Explanation of Reconciliation	Continue at Discharge
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
Yes No				Yes No
History Taken by: Time:		Date:	Medications to be reconciled by MD prior to discharge. New/changed medications should be added below.	
Medications Ordered (If "yes" or "no" circled on left above): MD Signature: Time:		Date:	Scanned to Pharmacy (used as order) by: Date: Time:	
New Discharge Medications and Changes to Pre-Admission Medications (name, dose and frequency): ☐ No new medications or changes to original home medications				New Rx written
				Yes
				Yes
				Yes
				Yes
				Yes
Discharge MD Signature:		Date:	Time:	
Note: this list of discharge medications is based upon information obtained from sources that typically include the patient/family and available records. Questions regarding medications prescribed by other providers should be directed to those providers.				

Carolinas HealthCare System
MEDICATION RECONCILIATION FORM
Admission and Discharge page 2

version 8-8-07

Patient Identifier

Figure 1. (continued)

described in this paper continue to meet TJC's revised expectations.

Although 78% of hospitals nationwide report pharmacy involvement in their hospital medication reconciliation initiatives, fewer than 5% employ pharmacy-provided admission drug histories.^{5,6} However, the number of pharmacy-based programs ensuring medication reconciliation is difficult to determine. This article describes a pharmacy-based medication reconciliation process improvement program piloted at Carolinas Medical Center Mercy that utilized both pharmacists and technicians.

METHODS

Carolinas Medical Center Mercy is an adult community hospital located in Charlotte, North Carolina, and is part of Carolinas Healthcare System (CHS). Mercy has an average daily census of 120 patients and an estimated 23 patient admissions daily. A full range of services are provided that include pulmonary, orthopedic, dialysis, bariatric, and cardiovascular care. Mercy's pharmacy department is open 24 hours and provides after-hours services to 8 sister facilities and around-the-clock services to 2 sister facilities. The pharmacy department is decentralized 16 hours daily and includes 26 pharmacists and 29 technicians. The pharmacists provide order entry and clinical services across multiple facilities. The primary clinical responsibilities at Mercy include intensive care unit (ICU) patient rounding, anticoagulation and antibiotic management, patient anticoagulation education, protocol monitoring and intervention, and, as a result of this pilot, admission medication reconciliation. The technicians' primary responsibilities pre pilot included medication admixture, filling, and distribu-

tion. Technician responsibility post pilot includes medication history completion.

In 2006, medication reconciliation began at Mercy as a multidisciplinary process utilizing nursing to obtain the drug histories, physicians to order and reconcile, and pharmacists to review and intervene on the orders received. CHS administration had set a benchmark of 90% or higher for drug reconciliation on admission per patient, but results continued to remain well below benchmark for approximately 2 years. In January 2008, hospital administration asked Mercy pharmacy to pilot a medication reconciliation program with the primary goals of achieving a 90% accuracy rate and a 90% reconciliation rate on medication reconciliation forms (Figure 1). Secondary goals set by pharmacy operations included improving completeness of the pre-admission list, tracking technician time estimates, tracking pharmacist time estimates, and tracking the number of technician- and pharmacist-completed medication histories daily.

Two pharmacy technicians and 1 pharmacist were added to the staff for the pilot that began in June 2008. During the pilot, dedicated medication reconciliation technicians obtained medications histories from patients during Mercy's peak admission hours from 10:30 a.m. to 8:00 p.m. Pharmacists checked the histories and intervened with the technicians as needed prior to physician receipt (accuracy component). After physician receipt, pharmacists cross-checked the medication list with the admission orders and intervened when discrepancies and/or omissions occurred (reconciliation component).

Patients included in the multidisciplinary portion of the data were admitted to Mercy through the emergency department or via direct admission from

Step #	Required Indicators: Admission	Yes	No
1	ACCURACY : Pre-admission home medications listed on the medication reconciliation form include name, dose, and frequency.		
2	RECONCILIATION : All medications on the medication reconciliation form (excluding PRN over the counter products) are reconciled with admission orders.		

Figure 2. Carolinas Healthcare System medication reconciliation data collection form for admission.

January 2008 through June 2008 (6 months). Patients included in the pharmacy-based portion of the data were admitted to Mercy through the emergency department or via direct admission between the hours of 10:30 a.m. and 8:00 p.m. and with histories obtained by the pharmacy technicians from July 2008 through December 2008 (6 months). All surgical patients and patients handled by pharmacy during the month of June were excluded from both data sets.

Data was collected via process improvement data collection sheets (Figure 2) and included accuracy of the medications on the list (drug name, dose, and frequency) and reconciliation of the medications on the list (compared to admission orders). Other descriptive data included the number of pre-admission medications found by multidisciplinary process versus pharmacy, the average time a technician took to obtain a medication history, the average time a pharmacist

took to review a medication history, and the average number of medication histories completed by the technicians daily as compared to estimated daily admissions during the study period.

Process improvement data were analyzed by calculating the number of accurate and the number of reconciled charts over the total number of charts reviewed. The number of pre-admission medications found by the multidisciplinary process versus the pharmacy process was determined by reviewing all pre-admission medication lists found in the medical record. The average time it took a technician to complete a medication history and the average time it took a pharmacist to review a medication history were captured by a computerized intervention tracking tool. The average number of medication histories completed by technicians was determined via daily tracking logs.

Figure 3. Comparison of a multidisciplinary medication reconciliation process (with nurses, physicians, and pharmacists) to a pharmacy-based process (with pharmacists and pharmacy technicians) upon admission into a tertiary care hospital. N = 360 patient charts per group. $P < .001$ for both accuracy and reconciliation in favor of the pharmacy-based process.

The optimal number of chart reviews was determined for sufficient power of 80% with a priori *P* value of .05. A total of 720 charts were retrospectively reviewed over a 6-month period immediately prior to (*n* = 360) and after (*n* = 360) the implementation of the pharmacy-based reconciliation program. Statistical significance was determined via chi-square analysis.

RESULTS

The primary goal process improvement results showed accuracy and reconciliation to be 45.8% and 44.2%, respectively, under the multidisciplinary process and 95% and 92.8%, respectively, under the pharmacy-based process, with *P* < .001 for both accuracy and reconciliation in favor of the pharmacy-

based process (Figure 3). The benchmark of 90% continued to be maintained post pilot under the pharmacy-based process (Figure 4).

The secondary operational goal results were obtained during the 6-month pharmacy-based portion of the pilot and were as follows: Mercy had an average of 19 nonsurgical admissions daily; of these, pharmacy technicians completed an average of 14 histories. It took the pharmacy technicians an average of 33 minutes to complete the history and associated documentation. It took the pharmacists an average of 5 minutes to review the documented history and route to the physician. Medications missing from the pre-admission list altogether under the multidisciplinary process and under the pharmacy-based process totaled 292 (9.2% missing) and 32 (0.8% missing), respectively.

Figure 4. Admission medication reconciliation run charts depicting process improvement gains over time. January 2008 through June 2008 depicts multidisciplinary process with nurses, physicians, and pharmacists. June 2008 through March 2009 depicts pharmacy-based process with pharmacists and technicians. Rapid improvement is achieved. Benchmark of 90% is maintained.

DISCUSSION

Medication reconciliation on admission to a health care system has provided many challenges with respect to the admission medication order process. Medication reconciliation has traditionally been assigned to nursing, although TJC does not mandate who should provide this service. Increased accuracy of medications per patient was demonstrated in a study utilizing pharmacy technicians to obtain medication histories.⁷ Knight et al reported a mean of 27 minutes per patient to collect a medication history.⁸ Strunk et al reported a 98% decrease in unreconciled medications per patient when a pharmacist was involved in medication reconciliation.⁹

This process improvement initiative did not directly assess adverse drug events or detail potential adverse drug event avoidance. The process improvement initiative instead addressed the basic question of whether a pharmacy-based medication reconciliation program utilizing both technicians and pharmacists improves the quality of the medication reconciliation process at Mercy as defined by accuracy and reconciliation on admission. The answer was a statistically significantly “yes” in favor of the pharmacy-based process and has been maintained as “yes” over time.

Further limitations included the lack of pharmacist involvement at discharge. A pharmacy-based admission and discharge option was presented to administration in the original plan, but estimated full-time equivalents (FTEs) needed to ensure a timely discharge process were deemed cost prohibitive for pilot considerations. However, the improved quality of the pharmacy prepared and reconciled admission medication list has increased the completeness and accuracy of the discharge medication list, because it is the admission list (along with the medication administration record) that is used at discharge. The opportunity to introduce new errors during the reconciliation of the list with the medication administration record during the discharge process remains. Several studies have shown that pharmacists can decrease discrepancies and readmission rates when they are involved in discharge medication reconciliation.¹⁰⁻¹⁴

The program process has continued to evolve as Mercy has moved medication reconciliation into the computerized provider order entry (CPOE) era. Mercy went live on CPOE in November 2011. Although medication list documentation has changed from paper to the computer, the histories are still completed by technicians and checked by pharmacists, and the

reconciliation is still ensured by the pharmacists. In other words, the framework of the process improvement initiative remains unchanged as a result of the CPOE roll-out.

Mercy's next process improvement steps may include assessing creative ways that pharmacists can positively and consistently impact the discharge reconciliation process with current resources, assessing the potential adverse drug event avoidance, and maximizing the use of the CPOE systems.

This process improvement initiative is the first to combine utilization of medication reconciliation technicians and pharmacists in preparing an accurate admission medication list and reconciling that list. We found that a pharmacy-based medication reconciliation process improvement program made a significant difference in the quality of the accuracy and reconciliation upon patient admission into our acute care facility. Based on the pharmacy-based process improvement results, we have retained the program and have expanded it into the surgical areas.

CONCLUSION

A pharmacy-based medication reconciliation process improvement program utilizing pharmacists and technicians significantly increased the accuracy and reconciliation of medications on admission at Mercy, and these results have been maintained beyond the 6-month study period per continued process improvement data collection.

REFERENCES

1. Geller KH, Guzman JL. JCAHO 2005 National Patient Safety Goals. *Focus*. 2005;1:1-8. http://www.fojip.com/Focus_2005_1.pdf. Accessed November 30, 2012.
2. Cornish PL, Knowles SR, Marchesanno R, et al. Unintended medication discrepancies at the time of hospital admission. *Arch Intern Med*. 2005;165:424-429.
3. Buckley B. Medication reconciliation still “the 800-lb gorilla in JC hospital compliance.” *Pharm Pract News*. 2009;36(1):20-21.
4. National Patient Safety Goals effective July 1, 2011. http://www.jointcommission.org/assets/1/6/NPSG_EPs_Scoring_HAP_20110706.pdf. Accessed November 30, 2012.
5. Pederson CA, Schneider PJ, Scheckelhogg DJ. ASHP national survey of pharmacy practice in hospital settings: prescribing and transcribing. *Am J Health Syst Pharm*. 2008;65:827-843.
6. Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. *Pharmacotherapy*. 2007;27(4):481-493.

7. Michels RD, Meisel SB. Program using pharmacy technicians to obtain medication histories. *Am J Health Syst Pharm.* 2003;60:1982-1986.
8. Knight H, Edgerton L, Foster R. Pharmacy technicians obtaining medication histories within the emergency department. *Am J Health Syst Pharm.* 2010;67:512-514.
9. Strunk LB, Matson AW, Steinke D. Impact of a pharmacist on medication reconciliation on patient admission to a Veterans Affairs medical center. *Hosp Pharm.* 2008;43:643-649.
10. Saunders A. Implementing a pharmacist-provided discharge counseling service. *Am J Health Syst Pharm.* 2003;60:1101-1103.
11. Wong JD, Bajcar JM, Wong GG, et al. Medication reconciliation at hospital discharge: evaluating discrepancies. *Ann Pharmacother.* 2008;42:1373-1379.
12. Setter SM, Corbett CG, et al. Effectiveness of a pharmacist-nurse intervention on resolving medication discrepancies for patients transitioning from hospital to home health care. *Am J Health Syst Pharm.* 2009;66:1012-1015.
13. Alibhai SM, Han RK, Naglie G. Medication education of acutely hospitalized older patients. *J Gen Intern Med.* 1999;14:610-616.
14. Beers MH, Munekata M, Storrie M. The accuracy of medication histories in the hospital medical records of elderly persons. *J Am Geriatr Soc.* 1990;38:1183-1187. ■