Implementation of a specialized pharmacy team to monitor high-risk medications during discharge

Medication discrepancies often occur during transitions of care, and patients with medication changes at hospital admission or discharge are at increased risk for adverse events and poor outcomes. Approximately 46% of medication errors are associated with patient orders issued during admission to or discharge from a hospital setting.¹

The prescribers at Scott and White Memorial Hospital (SWMH), a 630-bed nonprofit academic medical center with a large regional clinic system, use a computer-assisted medication reconciliation process to promote accurate and complete medication lists for patients at hospital discharge. As at many other hospitals, pharmacist review of medication discharge orders is not a systemic practice.

The lack of an effective mechanism within SWMH’s discharge reconciliation process to prevent the unintended omission of important medications from discharge records was identified in early 2010. In an analysis of this problematic process, polypharmacy among the hospital’s inpatients was considered a contributing factor in such unintended omissions. In response, hospital administrators requested that the pharmacy leadership consider how the pharmacy could participate in improving medication reconciliation and patient safety during the discharge process.

Multiple medications, so that pharmacists could consult with prescribers on any needed modifications of medication regimens before discharge. A review of hospital discharge data revealed that 40–70 patients with eight or more current medications were discharged daily. It was determined that providing an in-depth review of each patient’s medications would require 10 full-time equivalent (FTE) pharmacists.

Evidence-based practices for reducing omissions of medications from discharge records were reviewed,²⁻⁴ but an alternative pharmacy service strategy focusing on high-risk medications during discharge medication reconciliation was considered for SWMH.⁵⁻⁹ High-risk medications were defined as those whose unintentional omission from discharge documents could give rise to significant harm (and with little warning) during the interval between a patient’s discharge and his or her first postdischarge physician visit.

The high-risk medications identified as targets of the SWMH program included potent antiplatelet agents, anticoagulants, antiarrhythmics, and anticonvulsants. Although insulin and opiates are also considered high-risk medications, they were not included in the scope of the project because their unintended omission from a patient’s regimen is likely to be noted by the patient or family members before a serious consequence. An institutional analysis and literature review indicated that by focusing on the highest-risk medications, 20 patient discharges per day could be covered by three FTE pharmacists. The hospital’s leadership approved the discharge reconciliation approach recommended by the pharmacy depart-
ment and budgeted for the requested staff resources.

Program implementation. In July 2010, the new pharmacy service was formed and designated the High Risk Medication Team (HRMT). The team consisted of three full-time pharmacists who were tasked with developing the necessary processes to conduct the new service. Before implementing the service, the team addressed four important issues: (1) which specific medications to target, (2) how to identify patients receiving one or more of the target medications, (3) how to anticipate a patient discharge far enough in advance to allow sufficient time for pharmacy intervention, and (4) what days and hours to staff the service.

Determining which medications to target. The HRMT reviewed candidate drugs for inclusion on the hospital’s list of target high-risk medications in light of various factors: evidence in the literature, pharmacist workloads, adverse events previously experienced at the hospital, and the potential for the unintended omission of a drug from a patient’s discharge regimen to result in readmission diagnoses associated with high morbidity. Based on the literature review, high-risk medications considered for the HRMT target list included anticoagulants, narcotics, insulin, sedatives, anticonvulsants, antiarrhythmics, drugs delivered by inhaler devices, ophthalmics, oral hypoglycemic agents, oral methotrexate, and immunosuppressants. After discussion by HRMT members, it was decided that selected anticoagulants (warfarin, heparin, enoxaparin, fondaparinux, argatroban, bivalirudin), selected antiarrhythmics (amiodarone, digoxin, flecainide, sotalol, dronedarone, dofetilide, propafenone), and all anticonvulsants would be designated as target medications; narcotics, insulin, sedatives, drugs delivered by inhaler devices, and ophthalmics were excluded due to the large number of patients receiving these medications.

In addition, patients with certain diagnoses were selected for HRMT intervention based on the medications used in their treatment; these patients included those recovering from coronary stent placement (almost all receive antiplatelet agents) and those diagnosed with heart failure (in whom the use of digoxin, spironolactone, carvedilol, furosemide infusion, metolazone, and milrinone is common).

Patient identification. The HRMT proposed to identify patients receiving target medications by using the reporting capability of the pharmacy’s computerized order-entry system. A daily report that captured patients with active orders for the target medications was developed.

Anticipating patient discharge. In order to anticipate patient discharges, the team used the hospital’s electronic online bed-tracking system. Information provided by the system was reviewed at 20-minute intervals to identify patients with pending discharges. Once a discharge order was written, the pharmacist reviewed the discharge medication list to ensure the appropriateness of prescribed therapies, also noting medication safety concerns and monitoring requirements. Patients who were to be started on oral anticoagulants or antiplatelet agents at the time of discharge were targeted for counseling before discharge; if for some reason these patients did not receive pre-discharge counseling, they were contacted soon after discharge. With an average of only 90 minutes from the signing of a discharge order and the actual release of a patient from the hospital, the HRMT needed to maximize the effectiveness of patient review and intervention within a narrow window of time.

Staff scheduling. Schedules were developed according to the timing of discharge-order signature by physicians. SWMH discharge records showed that the majority of patient discharges occurred between 11 a.m. and 7 p.m., with a decreased number occurring between 7 p.m. and 9 a.m. Discharge times on weekends were clustered between 10 a.m. and 5 p.m., with the large majority occurring between 11 a.m. and 2 p.m. With three FTE pharmacists, it was determined that the service should operate from 7:30 a.m. to 8 p.m. daily in two shifts (7:30 a.m.–4 p.m. and 11:30 a.m.–8 p.m.). On weekends, one pharmacist would be scheduled for a 12-hour shift; on weekdays, two or three pharmacists would be scheduled for one 8-hour shift each, with the 4-hour overlap of the morning and afternoon shifts spanning the peak discharge period.

Program evolution. Throughout the development and implementation of the HRMT initiative, the list of target medications evolved to include additional agents, including newly approved anticoagulants (ticagrelor, dabigatran, rivaroxaban), with other changes made in response to the institution’s medication safety needs.

Oral methotrexate was added to the list due to the possibility of confusion resulting from daily dosing (as opposed to weekly inpatient i.v. dosing). Within the first six weeks of HRMT implementation, the number of dosing discrepancies identified and resolved validated the inclusion of oral methotrexate on the target list. Theophylline and lithium were also added to the list due to the potential for adverse drug reactions associated with their use and our ability to prevent those events by monitoring drug levels. The HRMT’s focus on lithium was later narrowed to nonpsychiatry patients only, as the psychiatric service providers were deemed likely to be appropriately managing lithium therapy in their patients.

Carvedilol, which was initially included on the target list with the aim of identifying patients with heart failure, was found to be commonly used in treating SWMH patients with multiple other disease states and was therefore removed from the list. Spironolactone was considered for removal from the high-risk medication list due to nonselectivity for heart failure patients; however, data collected during the early months of the program showed that about 20% of patients identified for HRMT intervention solely on the basis of spironolactone use (i.e., those not receiving any other high-risk medications) required intervention by the HRMT pharmacists before or at the time of discharge, so the drug was retained on the list.
A large number of patients identified on the basis of anticonvulsant use had indications other than seizures; thus, these agents were removed from the high-risk medication list except for carbamazepine and phenytoin, since those drugs are among the most problematic with regard to improper dosing and drug interactions.

**Experience with patient identification.** As a method to identify patients, an electronic report that identified patients with active orders for any of the target medications in the pharmacy’s order-entry system was developed. This report was generated by the pharmacist on his or her arrival in the morning. Most patients admitted after report generation were not captured until the following day; however, depending on the workload, the pharmacist sometimes ran the report again in the afternoon to capture these patients.

Other methods were developed in order to identify patients using a target drug that was prescribed as a home medication but withheld on hospital admission. To identify such patients, a medication reconciliation order was created in the pharmacy computerized order-entry system. All of the department’s pharmacists were supplied with a list of the target medications, and a medication reconciliation order was entered into the patient’s profile (along with the patient’s other inpatient medications) that included the name of the target medications being withheld. This medication reconciliation order was incorporated into the daily morning report as another method to capture patients receiving target medications.

In a related move to enhance patient identification, phytonadione and digoxin immune Fab were designated as target medications with the aim of identifying patients with orders specifying that warfarin or digoxin be withheld during their hospital stay. The SWMH outpatient anticoagulation clinic maintains a daily list of all clinic patients who are admitted to the hospital; this list helped in identifying patients whose home use of warfarin had been discontinued at the time of hospitalization.

In addition, the HRMT sought to identify patients with conditions that could potentially lead to the initiation of treatment with a target drug during their hospital stay. To that end, the hospital’s catheterization laboratory schedule was reviewed daily in order to identify patients who were candidates for antiplatelet therapy.

Through all of these methods combined, an average of 28 new patients each day were identified for HRMT intervention.

**Experience with patient discharge.** Almost immediately after implementation of the program, the HRMT realized that the short time between the signing of discharge orders and the patient’s departure from the hospital did not allow a thorough pharmacist review of the discharge medications, pharmacist counseling on discharge medications, and oversight of scheduled follow-up monitoring. Therefore, the team’s emphasis was quickly shifted to conducting medication reviews soon after patient identification. This allowed pharmacists more time to contact outside providers or pharmacies to verify medication dosing in order to correct medication discrepancies and provide appropriate monitoring. In addition, direct patient counseling and interaction were increased during the patient’s inpatient stay, resulting in fewer telephone follow-ups for postdischarge medication counseling or dosing clarifications. These efforts to establish postdischarge contact with patients were largely successful, and few patients failed to respond to the HRMT’s follow-up telephone calls.

The team found that physicians were more accepting of recommendations before the final discharge orders were signed, as any subsequent changes required that orders be rewritten. The online bed-tracking system used to anticipate discharges did not always yield timely information; thus, the pharmacy department decided to change processes so that all scanned hospital discharge orders were transmitted to the pharmacy and routed to the HRMT printer.

**Experience with staff scheduling.** In addition to reviewing discharge orders, the morning pharmacist was responsible for identifying and reviewing the profiles of newly admitted patients each day, documenting their chief complaint, target medications and indications, past medical history, and pertinent inpatient concerns.

The 4.5-hour pharmacist shift overlap in the afternoon allowed for appropriate staffing during hours when discharges were most anticipated. Despite pre-implementation data indicating brisk discharge activity up to 8 p.m., post-implementation experience showed that the vast majority of discharges occurred before 6 p.m., after which time the HRMT had inconsistent success in reaching physicians or otherwise resolving problems. As a result, the second shift was moved forward 1 hour (to 10:30 a.m.–7 p.m.), and the weekend shift hours were changed to 8 a.m.–6 p.m. Currently, the HRMT pharmacists rotate between the weekend and early and late weekday shifts in a three-week cycle.

**Impact of the HRMT service.** Medication discrepancies and problems at discharge have been well described in the literature, and the implementation of the HRMT enabled the identification and documentation of many important patient interventions. During the first six months of the program (January–June 2012), the types of interventions made on discharge orders included correcting unintended omissions and additions of medications, dosing changes, and clinical recommendations. An average of 17% of all discharge orders reviewed by the HRMT have required resolution for unintentional medication changes or inadequate warfarin follow-up arrangements, as well as clinical recommendations for medication safety. Of note, the HRMT improved its effectiveness in the second year of the service, as indicated by a higher number of clinical interventions. Currently, the rate of physician acceptance of the team’s clinical recommendations is 75%.

**Lessons learned and future directions.** To our knowledge, no formal study has been conducted to compare narrowly targeted, medication-specific
strategies for patient medication review (such as the strategy implemented at SWMH) with more broadly targeted strategies (e.g., reviewing all patients on a particular hospital unit). By reviewing discharge orders for patients receiving high-risk medications, pharmacists are in a position to focus on interventions that can have a great impact on patient safety. However, patients who are not targeted could also benefit from medication review by a pharmacist prior to discharge. An evaluation to show patient safety improvements achieved would be beneficial to the pharmacy administration when considering the initiation of a program similar to that described here. Such an analysis would be useful in determining the most effective and efficient role for pharmacists, but that type of research may be more easily conducted before full implementation of the program.

The experience gained and the challenges encountered at SWMH have revealed several important factors in successfully implementing a program such as the HRMT service. Teaching hospitals and facilities with high patient turnover rates would especially benefit from this type of service, which would also be ideal for a hospital with its own network of outpatient clinics, as a mechanism to facilitate continuity of care.

It has been important to this service to keep detailed statistics on interventions and the types of problems solved, not only to demonstrate the continued value of the service to the hospital’s leadership but also to help identify areas for improvement. Some of the interventions have involved medications other than those on the HRMT target list. For example, the HRMT has contributed to antibiotic streamlining at discharge, often ensuring proper i.v.-to-oral conversion of medications, as well as dose adjustments based on renal function. The team is currently considering increased involvement in inpatient antibiotic streamlining, as patients are likely to continue to receive these agents after discharge.

The hospital is developing more roles for pharmacists to improve medication management in heart failure patients and is considering the involvement of the HRMT. In addition to the wide variety of services already performed, the HRMT continues to expand as new initiatives are presented.


Emory S. Martin III, Pharm.D., BCPS, Vice President, Pharmacy Services
Renee L. Overstreet, Pharm.D., BCPS, Patient Care Pharmacist
Lori R. Jackson-Khalil, Pharm.D., Patient Care Pharmacist
Holly L. McCollough, Pharm.D., Patient Care Pharmacist
Tricia A. Meyer, M.S., Pharm.D., FASHP, Pharmacy Director
Qing Xu, Pharm.D., Patient Care Pharmacist

Scott and White Memorial Hospital
2401 South 31st Street
Temple, TX 76508

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