Pharmacist-managed inpatient discharge medication reconciliation: A combined onsite and telepharmacy model

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Telepharmacy services have been successfully used by various healthcare institutions as an alternative way of extending pharmacy coverage where pharmacy services are not provided 24 hours a day and as a way of supporting existing pharmacy services at a particular institution. The National Association of Boards of Pharmacy (NABP) defines the practice of telepharmacy in its Model State Pharmacy Act as “the provision of pharmacist care by registered pharmacists and pharmacists located within U.S. jurisdictions through the use of telecommunications or other technologies to patients or their agents at distances that are located within U.S. jurisdictions.” In addition, the 2013 American Society of Health-System Pharmacists (ASHP) House of Delegates approved a policy to advocate that boards of pharmacy and state agency regulations regarding telepharmacy services address service arrangements for workload relief in the point-of-care pharmacy during peak periods and service arrangements that cross state borders. The use of telecommunications and related tools and equipment has given the pharmacy profession the

Purpose. The development, implementation, and pilot testing of a discharge medication reconciliation service managed by pharmacists with offsite telepharmacy support are described.

Summary. Hospitals’ efforts to prepare legible, complete, and accurate medication lists to patients prior to discharge continue to be complicated by staffing and time constraints and suboptimal information technology. To address these challenges, the pharmacy department at a 324-bed community hospital initiated a quality-improvement project to optimize patients’ discharge medication lists while addressing problems that often resulted in confusing, incomplete, or inaccurate lists. A subcommittee of the hospital’s pharmacy and therapeutics committee led the development of a revised medication reconciliation process designed to streamline and improve the accuracy and utility of discharge medication documents, with subsequent implementation of a new service model encompassing both onsite and remote pharmacists. The new process and service were evaluated on selected patient care units in a 19-month pilot project requiring collaboration by physicians, nurses, case managers, pharmacists, and an outpatient prescription drug database vendor. During the pilot testing period, 6402 comprehensive reconciled discharge medication lists were prepared; 634 documented discrepancies or medication errors were detected. The majority of identified problems were in three categories: unrecognized medication orders (31%), order clarification (25%), and duplicate orders (12%). The most problematic medications were the opioids, cardiovascular agents, and anticoagulants.

Conclusion. A pharmacist-managed medication reconciliation service including onsite pharmacists and telepharmacy support was successful in improving the final discharge lists and documentation received by patients.

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ability to provide pharmacist-related services to patients and organizations remotely, often across state lines. Typical telepharmacy services include order review and processing, drug dispensing, drug compounding and admixture verification services, drug information, patient assessment, patient counseling, patient therapeutic drug monitoring, and medication therapy management. However, there are no published reports describing the use of telepharmacy services in the area of medication reconciliation.

In 2005, the Joint Commission established medication reconciliation as a National Patient Safety Goal and a means to reduce patient harm from adverse drug events (ADEs). Medication reconciliation is defined by the Joint Commission as “the process of comparing the medication(s) a patient is taking (or should be taking) with newly ordered medications in order to resolve discrepancies or potential problems.” Other national quality-improvement organizations, such as the Institute for Healthcare Improvement in its 100,000 Lives campaign, have advanced ADE prevention as a national priority. Since some ADEs may be linked to unclear or confusing medication lists, both organizations are encouraging healthcare institutions to perform medication reconciliations as a method of reducing ADEs. Medication reconciliation is to be conducted at transitions in care, such as on the admission and discharge of hospitalized patients. There is extensive evidence that medication discrepancies (i.e., omissions, duplications, contraindications, and unclear information) can affect patient outcomes. Previous published literature from ASHP and the American Pharmacists Association encouraged healthcare institutions to develop an effective process for medication reconciliation so as to reduce medication errors and support safe medication use by patients. Based on the literature, past experience has shown that a lack of medication reconciliations accounts for 46% of all medication errors and approximately 20% of ADEs in the hospital setting. Pharmacists possess distinct knowledge, skill, and ability and are therefore uniquely qualified to lead interdisciplinary efforts to establish and maintain effective medication reconciliation processes for hospitals and other healthcare facilities.

ASHP has stated that pharmacists are challenged with five fundamental responsibilities for medication reconciliation: (1) to develop policies and procedures regarding medication reconciliation processes, (2) to implement and improve medication reconciliation processes, (3) to train and assure the continued competency of those involved in medication reconciliation, (4) to provide expertise and knowledge in the development of information systems that support medication reconciliation, and (5) to advocate for medication reconciliation programs in the community. Medication reconciliation is an achievable step in preventing some medication discrepancies from resulting in actual medication errors and patient harm. The fiscal impact of ADEs due to medication errors is substantial and often preventable.

Problem
Performing discharge medication reconciliations competently requires effective systems, time, and accuracy. Individuals performing medication reconciliation should have extensive medication knowledge and understanding of medication use across the continuum of healthcare. The clinical pharmacist should be visible and instrumental in accomplishing this task. However, onsite clinical pharmacists at Sibley Memorial Hospital–Johns Hopkins Medicine, a 324-bed community hospital in Washington, D.C., were also expected to use their expertise to provide other services in the hospital; medication reconciliation was only one of their potential duties.

Before November 2011, patients who were discharged from Sibley received, in addition to actual written prescriptions, three separate discharge forms addressing medication instructions: a computer printout of both their medications prior to admission and their hospital medications at discharge, a handwritten title “Additional Medications at Discharge,” and a form titled “Inpatient Discharge Instruction Sheet” (appendix). Under the previous system, the responsible physician, physician assistant, or another prescriber marked a check next to the listed drugs indicating that therapy was to be continued or discontinued. Frequently the prescriber would cross out, circle, or otherwise modify the printed discharge list to convey final patient discharge medication instructions. Orders for new discharge medications (i.e., those not included on the list of medications taken prior to admission or the list of active hospital medications) were handwritten by the prescriber, typically with medical abbreviations, on the “Additional Medications at Discharge” form; in some cases, prescribers provided written prescriptions in addition to the discharge form. The discharging nurse would complete the final step by reviewing all the forms and prescriptions with the patient and/or a caregiver. The nurse obtained the patient’s signature as documentation of this activity for the medical record. This process was cumbersome and unsatisfactory for many providers and patients. The discharge documents provided patients with copious paper handouts and a confusing and sometimes illegible, inaccurate, or incomplete discharge medication list.

Analysis and resolution
Background. In 2011, in response to staff observations and patient feedback, the hospital’s administration and the medication reconciliation...
tion subcommittee of its pharmacy and therapeutics committee concluded that the current practice of providing patients with a partially handwritten, inconsistently verified discharge medication list was not adequate to maximize patient safety for the medical, surgical, psychiatric, or skilled nursing care patients at the facility. The hospital’s health records were partially electronic, but functionality for an integrated electronic medication reconciliation process was not imminent. A new electronic health record (EHR) was envisioned within the next 24 months. Therefore, based on the literature13 and given Sibley Memorial Hospital’s need for additional leadership and practice advancement in the area of medication reconciliation, a pharmacist-managed pilot medication reconciliation service was advocated and supported.

Since clinical telepharmacists were already working with the hospital’s clinical pharmacy service to supplement the preadmission medication reconciliation process through the emergency department, additional support was sought for the discharge medication reconciliation. This project was developed under the auspices of the subcommittee, which was chaired by the pharmacy director and supported by the hospital’s administration. Workflow redesign, staffing plans, and operational and educational resources, as well as policies and procedures, were prepared and used to train and instruct the pharmacists, pharmacy assistants, nurses, unit secretaries, and hospital-based physicians involved in pilot testing the medication reconciliation process.

Project overview. Providing clinically trained telepharmacists from an established, licensed telepharmacy provider during certain service hours was recognized by the hospital as a strategic approach to advance the discharge medication reconciliation project. An additional advantage of the combined onsite–telepharmacy approach was that it could be implemented within a few weeks and operated at a lower cost relative to the hospital’s traditional staffing model.

Under the system envisioned for implementation at Sibley, the telepharmacists would support the onsite clinical pharmacists in three ways. First, they would enable the onsite clinical pharmacists to attend to other clinical duties (e.g., formulary management, ADE monitoring, staff education, drug information). Second, they would provide consistency in the quality of the patient’s medication reconciliation discharge list. Last, they would provide services during evenings, weekends, and holidays. Both the onsite pharmacists and telepharmacists received the same supplemental education and training in preparation for this quality-improvement project. They both used the same pharmacy assistants and had access to the same computer systems and other electronic resources. The main difference between the onsite clinical pharmacy service and the telepharmacy service was the hours of coverage of medication reconciliation duties.

A revised work process, along with supplemental tools and resources, was developed by the medication reconciliation subcommittee and the telepharmacy provider. This process was implemented in order to eliminate the poor-quality documents being provided to patients at discharge, avoid extra paperwork for the providers (when possible), and provide patients with a comprehensive list of their reconciled medications at the time of discharge. The process used a multidisciplinary approach involving physicians, nurses, discharge coordinators, pharmacists, pharmacy assistants, unit secretaries, and patients. The education and training department of the patient care services division, as well as the discharge coordinators from the case management division, worked closely with the pharmacy team to identify staff training needs. The pharmacy team provided inservices on all affected nursing units. The hospital’s policy and procedure for medication reconciliation were updated to reflect the new process. The pharmacists involved were provided training and access to an outpatient prescription records database. This database provided information regarding outpatient prescription fill history from retail and mail-order pharmacies, including drug name, drug strength, (occasionally) the scheduled frequency, the date the prescription was filled or refilled, and the prescriber’s name. Notably, for some patients, e-prescribing records were also available, typically providing a complete description of the medication (strength, dosage form, dose, route, and frequency of use) and the name of the prescriber. The information in the database was used as a resource by the clinical pharmacists to identify gaps in patients’ home medication lists that required clarification.

Involvement in initial project. The private medical and surgical attending physicians at Sibley discharge patients from all critical care, psychiatric, skilled nursing, medical, and surgical units in the hospital. These attending physicians and their patients were recognized by the subcommittee as the priority group for the pharmacist-managed discharge medication reconciliation service. The hospitalists group assumed responsibility for reconciling and finalizing the consolidated computer-generated discharge medication list for the patients on their respective services when serving as attending physicians. Reconciling patients’ medication lists was part of the hospitalists’ contracted duties. They also were mostly rapid adopters of new computer technologies and hospital-based processes for clinical activities, including medication reconciliation. The clinical pharmacists (either onsite pharmacists or telepharmacists) as-
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assumed responsibility for all other discharged patients. They reviewed the discharge paperwork for patients on the following units: intensive care–telemetry, skilled nursing–rehabilitation, orthopedics, oncology–medical, telemetry, medical–surgical, and behavioral health. Pilot testing on the critical care, medical–surgical, and skilled nursing units was implemented over four weeks in an incremental fashion, with service to the behavioral health unit established last. The women-and-infant service was not included in the pilot project.

Revised medication reconciliation process. The new discharge medication reconciliation process was performed as follows. A nurse printed out from the hospital computer system a “crystal report” that listed home medications, including nonprescription products, as well as the active hospital medications, for a patient who was scheduled to be discharged. This report was provided to the discharging physician (or another prescriber), who reviewed this list of medications and checked off which home medication(s) should be continued and/or which hospital medication(s) should be discontinued; prescriptions for any new or changed medications were manually written or printed out at that time. Once completed, the physician’s reports and discharge prescriptions were transmitted to the pharmacy service electronically. A pharmacy assistant prepared a preliminary computer-generated, comprehensive medication reconciliation list. This list was reviewed by a clinical pharmacist, who compared the preliminary comprehensive medication reconciliation list with the physician’s report and with information on the patient’s current hospital medications and discharge prescriptions, as well as information from the outpatient prescription database, in order to address any errors or discrepancies in collaboration with the physician, nurse, or other prescriber.

The projected turnaround time for the new medication reconciliation process was one to two hours. This period of time started from when the discharge paperwork left the nursing unit to go to the pharmacy department and ended when the pharmacist signed and sent the final discharge medication list to the nursing unit. The nurse reviewed the final list with the patient and/or a caregiver. The nurse and patient also had an opportunity at this stage to identify any undetected medication discrepancies, which could then be corrected by the pharmacist before a revised final list was sent to the patient. A signed copy of this final document was also placed in the patient’s chart by staff on the unit.

Onsite pharmacist and telepharmacist schedules. The pharmacist-managed service was staffed over 90% of the time by one clinical pharmacist and one pharmacy assistant from 0900 to 2000 Monday–Friday and from 0900 to 1800 on Saturdays, Sundays, and holidays. The telepharmacy service operated during weekdays from 1200 until 2200 and on weekends and holidays. Additional coverage was provided by the telepharmacy service as needed per request of the pharmacy department. The coverage provided by the telepharmacists allowed the onsite clinical pharmacists to redirect their efforts toward other clinical duties and promoted continuity of care for patients discharged after-hours. The telepharmacy service remotely accessed the hospital’s inpatient computerized pharmacy system and other EHR documents, as well as the emergency department’s separate EHR system, through channels compliant with requirements of the Health Insurance Portability and Accountability Act of 1996. Routine communication between the pharmacy team, unit staff, and medical staff was conducted via phone, fax, or inhouse e-mail.

Project findings. During the period November 2011–May 2013, 6402 discharge medication lists were prepared using the medication reconciliation process described above. On average, the pharmacy team prepared 331 discharge lists per month, with a range of 8–30 per day. The average number of medications per discharged patient was 10. During the preparation of the 6402 discharge lists, 634 medication discrepancies were identified, clarified, and documented by the pharmacist-managed service (missing indications for routine medication orders, a recommended part of the medication list at discharge, were not included in the analysis of discrepancies or potential errors; however, per hospital policy, missing indications for as-needed orders were documented as potential errors). The majority of the medication discrepancies were identified on lists prepared for the skilled nursing–rehabilitation, orthopedics, and medical–surgical units, which accounted for 193 (30%), 181 (29%), and 167 (26%) of the discrepancies, respectively. The discrepancies were divided into 10 main categories:

1. Allergy—The patient had a documented allergy to the medication ordered or there was the potential for cross-sensitivity to occur.
2. Automatic substitution not reversed—During hospital admission, the patient’s usual home medication was switched to a formulary alternative; upon discharge, the formulary alternative was checked off to be continued in addition to or instead of the usual home medication.
3. Discontinued medication—A medication was discontinued sometime during admission but was to be restarted on discharge (alternatively, the medication was to be discontinued upon discharge but was included on the patient’s medication reconciliation list to be continued at home).
4. Dose adjustment—A medication order required a dosage adjustment based on laboratory values (e.g., International Normalized Ratio for...
warfarin monitoring) or the patient’s clinical status.
5. Drug interaction—The patient was prescribed a combination of medications with potentially contraindicated or significant drug interactions that required dosage adjustments and/or monitoring.
6. Duplicate order—Multiple similar medications, usually from the same drug class and with the same indications for use, were listed on the patient’s discharge medication list.
7. Incomplete order—A medication order on the discharge list was missing key elements such as dose, route, frequency of administration, or indication for use for an as-needed order.
8. Omission—A medication list was missing maintenance home and/or hospital medications that were not reordered or continued at discharge.
9. Order clarification—A medication order required verification of intent or clarification due to illegibility or had other discrepancies that could not be adequately defined under the other 9 categories.
10. Unreconciled medication—A medication list had multiple entries of the same drug or the list included dosages, frequencies of administration, and/or instructions that differed from those specified on the actual prescription order(s).

Select errors or discrepancies recognized by pharmacists at the time of discharge are described in Table 1. The most common discrepancies found by the clinical pharmacists involved unreconciled medications (n = 196, 31%), order clarification (n = 158, 25%), duplicate orders (n = 70, 11%), omissions (n = 70, 11%), and incomplete orders (n = 70, 11%). These categories alone accounted for a total of 561 (89%) of the documented interventions. The allergy, automatic substitution not reversed, discontinued medication, dose adjustment, and drug interaction categories accounted for the remaining 73 discrepancies (11%). The drug classes associated with the most discrepancies were the opiate agonists (n = 181, 28.6%), cardiovascular agents (n = 101, 15.9%), and anticoagulants (n = 40, 6.3%), followed by two other drug classes: (1) anxiolytics, sedatives, and hypnotics and (2) nutrients and nutritional drugs.

The process of preparing a comprehensive discharge medication reconciliation list had some obstacles. These obstacles included (1) limited information on indication for use for routine medications, (2) insufficient turnaround time, and (3) incomplete medication instructions or directions for nutritional or herbal medications. Obtaining information on indication for use was one of the first issues encountered. In an audit targeting the first 100 patients whose medication lists were reviewed during the pilot project, the indication for use for routine scheduled medications for patients on the inpatient behavioral health unit (e.g., antiparkinson and cardiac drugs) was absent from the prescriber’s discharge list about 50% of the time despite Centers for Medicare and Medicaid Services core measure requirements calling for prescribers to document the indication for use for all medications ordered for such patients. Consequently, the pharmacist-managed discharge service noted an increase in physician documentation of indication on the behavioral health unit. For all other units, the pharmacists worked concurrently with the medical staff to assure that the documentation of indication for use for routine medications was included in the discharge medication list.

Time constraints were also problematic. Turnaround time was affected when patient discharges occurred abruptly or when all required documentation or clarifications did not occur in a timely fashion. Pharmacists needed time to prepare the lists and correct any discrepancies with the assistance of physicians or patients via the outpatient prescription database. Although the applicable hospital policy stipulated that pharmacists were to prepare the comprehensive medication reconciliation lists within one to two hours, in reality it became clear that in order to ensure that patients received their list before they left the hospital, a turnaround time of one hour or less was necessary in many cases.

In certain instances, some discrepancies, such as those involving nonprescription medications, vitamins, or supplements, could not be clarified with the nurse, physician, or patient or through database review prior to hospital discharge. When this occurred, patients were instructed by the clinical pharmacists to follow up with their primary care physicians for further clarification or to continue using the products according to previous home dosage instructions; instructions of this sort were documented on the discharge list. In a small number of cases, the onsite clinical pharmacist or the telepharmacy service directly contacted the patient or a caregiver to ensure proper clarification of problems with the discharge medication list—for example, problems pertaining to warfarin dosing.

The service relied heavily on information supplied by patients on the admission medication history or captured by conventional methods. Based on professional experience and experience during other quality-improvement initiatives performed at the hospital, errors of both omission and commission during admission medication reconciliation are routinely observed.

Discussion
An accurate medication history is essential in the healthcare environment and has been shown to give providers valuable insight into patients’ medical and medication histories. The patient’s medication history is especially important during transitions in care between healthcare
Table 1. Select Cases of Discrepancies Clarified by the Pharmacist-Managed Telepharmacy Service

<table>
<thead>
<tr>
<th>Intervention Category</th>
<th>Initial Discharge Order(s)</th>
<th>Problem(s) and Intervention(s)</th>
<th>High-Risk Category</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy</td>
<td>Oxycodone (extended-release) 10 mg twice daily, oxycodone (immediate-release) 5 mg, 1 or 2 tablets every 3–6 hr as needed for pain</td>
<td>Patient had documented allergy to oxycodone. Physician contacted.</td>
<td>Yes</td>
<td>Medication discontinued; alternative pain medication ordered.</td>
</tr>
<tr>
<td>Automatic substitution not reversed</td>
<td>Telmisartan–hydrochlorothiazide daily and irbesartan–hydrochlorothiazide daily</td>
<td>Patient was receiving telmisartan–hydrochlorothiazide before admission; discharge instructions stated to include home medication and hospital formulary substitute. Physician contacted.</td>
<td>No</td>
<td>Irbesartan–hydrochlorothiazide discontinued.</td>
</tr>
<tr>
<td>Discontinued medication</td>
<td>Insulin (sliding scale doses)</td>
<td>Patient without diabetes was started on insulin because of high blood glucose levels caused by steroids therapy. Physician contacted.</td>
<td>Yes</td>
<td>Medication discontinued.</td>
</tr>
<tr>
<td>Discontinued medication</td>
<td>Potassium chloride 40 meq orally daily</td>
<td>Patient’s medication profile at discharge included potassium supplement. The potassium had been discontinued during admission.</td>
<td>No</td>
<td>Potassium discontinued.</td>
</tr>
<tr>
<td>Dosage adjustment</td>
<td>Warfarin 1 mg orally daily</td>
<td>Physician contacted. Based on patient’s INR at discharge, pharmacists recommended dosage adjustment to 2 mg daily.</td>
<td>Yes</td>
<td>Discharge order changed to warfarin 2 mg daily by physician.</td>
</tr>
<tr>
<td>Drug interaction</td>
<td>Citalopram and sumatriptan</td>
<td>Physician contacted. Drug interaction between citalopram (newly prescribed) and sumatriptan may increase risk of serotonin syndrome. Nurse contacted and instructed to educate patient regarding the symptoms of serotonin syndrome; educational tool provided.</td>
<td>No</td>
<td>Patient educated regarding symptoms of serotonin syndrome.</td>
</tr>
<tr>
<td>Duplicate order</td>
<td>Lisinopril daily and losartan–hydrochlorothiazide daily</td>
<td>Nurse learned that lisinopril was once part of patient’s hypertension regimen but was discontinued in favor of losartan–hydrochlorothiazide daily. Physician contacted.</td>
<td>No</td>
<td>Lisinopril discontinued by physician.</td>
</tr>
</tbody>
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settings, levels of care, and providers. Patients must be provided with legible, complete, and updated discharge lists as a means of promoting patient safety and medication adherence. The novel pharmacist-managed discharge medication reconciliation service pilot tested during the project required pharmacy and administration leadership and support, as well as multidisciplinary collaboration. The use of readily available modern communication modalities, print and EHR documents, and an outpatient pharmacy prescription database aided in the development of complete, legible, and reconciled discharge medication lists.

Significant amounts of time were expended during the reconciliation process. Time limitations, including those related to staff workloads, have been described in other studies involving medication reconciliation processes. The advent and availability of more sophisticated and integrated electronic medical records, as well as improved patient access to complete and accurate admission medication histories, should further promote the quality and efficiency of medication reconciliation practices at the time of hospital discharge.

The information and experience gathered from this project support a growing body of evidence indicating that patients’ discharge medication lists should be routinely reconciled in a multidisciplinary manner through a process led by pharmacists. Collaboration by an onsite clinical pharmacy service and a telepharmacy provider proved successful in delivering hospitalwide discharge medication reconciliation services to patients, thereby advancing a Joint Commission–designated National Patient Safety Goal while promoting patient satisfaction and potentially improving medication-use outcomes.

**Conclusion**

A pharmacist-managed medication reconciliation service including onsite pharmacists and telepharmacy support was successful in improving the final discharge lists and documentation received by patients.

**References**


Appendix—Discharge documentation provided to patients before and after pilot project

**Documentation before pilot project**
- Computer printout of all preadmission and hospital medications
- Form titled “Additional Medications at Discharge”
- Form titled “Inpatient Discharge Instruction Sheet”
- All handwritten prescriptions given to patient

**Problems with discharge documentation before pilot project**
- Too many pages given to patient
- Handwritten changes charted over printed forms; illegibility often encountered
- Orders unreconciled, duplicated, incomplete, or unclear
- Some directions written in medical abbreviations
- Difficult for the nurse to review medication list with patient
- Difficult for patient to know which medications were unchanged, changed, or new

**Documentation during pilot project**
- One form (“Discharge Medication List”) containing the reconciled information, as opposed to the previously used three forms, given to patient
- All handwritten prescriptions given to patient

**Advantages of pilot-tested discharge documentation**
- One comprehensive reconciled medication list with all current medications given to patient
- Complete list of the active medications clearly typed out
- Medication errors and discrepancies clarified
- Indication for use provided for majority of routine and all as-needed medications, as well as required postdischarge laboratory orders for medication monitoring (e.g., International Normalized Ratio determination for warfarin monitoring) noted at bottom of form
- All directions for use documented in lay terminology
- Easier for the nurse to review list with patient
- Easier for patient to review one comprehensive discharge medication list

11. Institute for Healthcare Improvement. 100,000 Lives campaign. www.ihi.org/IHI/ProgramsCampaigns100kCampaignOverviewArchive.htm (accessed 2013 Sep 10).