Piloting Medication Histories in a Pediatric Postanesthesia Care Unit

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Purpose: *Develop a medication history process for pediatric postanesthesia care unit (PACU) patients to identify discrepancies between home and inpatient medications and prevent medication errors.*
Design: *Pilot an evidence-based practice change to perform PACU medication histories.*
Methods: *Inpatients or surgical admissions to general care units at a pediatric tertiary care 348-bed hospital ages 2-18 years were included. Parents/guardians were asked about their child's prescription and over-the-counter medications, allergies, and adherence. Data included patient age, surgery, medication categories, and error classifications. Information was compared to the patient's medical record.*
Findings: *From June to July 2016, 75 medication histories were performed, covering 44.6% of eligible cases within the period. Seventy-four discrepancies were found, the most frequent being omission. The medication category with the most errors was vitamins/herbals/supplements.*
Conclusion: *The workflow designed assessed discrepancy frequency and type in surgical patients' medication lists when transitioning from the PACU to general care units.*

Keywords: *discrepancy, omission, pharmacy, pediatrics.*

WITH EVERY CARE TRANSITION of a patient there is an increased risk for medication discrepancies.[1] Medication discrepancies, if not properly managed, lead to a higher risk of medication adverse effects, increased emergency department admissions, and even death.[2] In fact, in the United States, medical errors rank as the third leading cause of death.[3] Many of these errors are preventable and often due to medication omission, underuse, or overuse at care transitions.[4] Pediatric patients have a three times greater risk of medication error, with 5% to 27% of orders leading to an error.[5] In addition to the major health consequences of medication errors, they also have a huge economic impact on the health system.[1] One study found that adverse drug events are estimated to cost $5.6 million per hospital per year, with many preventable medication errors resulting from overuse, underuse, or prescribing or dispensing errors.[6]

As a result of the economic and medical impact of medication errors, the Joint Commission has emphasized in its patient safety goals the importance of medication and reconciliation at all care transitions.[7] The Joint Commission's National Patient Safety goal 8 of 2006 calls for health systems to develop a process to obtain and document a complete list of the patient's current medications on admission. Furthermore, goal 8 of the Joint Commission requires that patient medications

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Conflict of interest: None to report.

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1089-9472/$36.00
https://doi.org/10.1016/j.jopan.2018.03.004

are communicated to the next provider of service when the patient undergoes a care transition within or outside the health system. The goal is to develop a process that provides efficient and accurate medication histories for patients at each care transition. Most recently, goal 3 of the 2017 National Patient Safety Goals involves improving safe and accurate use of medications through medication reconciliation and discrepancy resolution.[8] Components of this goal include collecting information on the patient's current medications (including drug name, dose, route and frequency of administration, and indication), comparing these medications to hospital orders to identify discrepancies, and providing patients with medication management information at the end of a given stage of care.[8]

Surgical patients are at high risk of medication errors because of new postoperative medications and unintended alteration of regular regimens.[9,10] In addition, the consequences of a medication error may be higher in the pediatric population. Little research has been conducted with regard to the impact of medication histories in a postanesthesia care unit (PACU) within a pediatric hospital. Providing an accurate medication history on a patient before their transition from a PACU to the hospital floor may reduce medication errors.

Medication histories performed by trained pharmacy personnel have been shown to be more accurate than histories performed by other professionals.[1] One study demonstrated the importance of medication histories in the pediatric population by pharmacy staff at specific transition points.[1] The study by Provine et al[11] examined more than 100 medication histories and found a total of 309 discrepancies, many of the discrepancies classified as medication omission. Overall, Provine et al[11] showed the beneficial impact that pharmacists can have on patient care at different transition points. Another study by students at Ferris State University searched for new strategies to gather accurate medication histories by having pharmacy students examine medical charts.[12] Pharmacy students examined more than 300 patient charts and interviewed patients or patient family members to obtain an accurate medication history.[12] In addition, students would contact the patient's community pharmacy to assist in identifying omitted medications.[12] It was found that 53.7% of medical charts had missing prescription medications that were not properly documented and 51.2% of charts had missing nonprescription and natural products.[12] This study demonstrates that using pharmacy students in performing medication histories also provides extensive benefit to the patient's care.

A study by Gonzalez-Garcia et al[9] examined medication reconciliation at admission to surgical departments. The study compared the preadmission medications of the patient with the medication received at the hospital 24 to 48 hours after admission.[9] They found that there was a high prevalence of reconciliation errors, especially in those with scheduled surgeries and those with a higher volume of preadmission medications.[9] Overall, surgical patients are found to be more prone to medication discrepancies, especially during the transition of care.

Current research in medication histories and documentation errors is lacking in the pediatric surgical population. A prospective study was performed at C.S. Mott Children's Hospital to identify medication discrepancies at discharge, specifically for the pediatric population. The study compared three medication lists for patients who were admitted to a general pediatric hospital floor for more than 24 hours.[13] The medication lists were used to identify discrepancies defined as medication name, dose, route, or frequency and classify error type.[12] From this study, it was found that omission/admission errors were more common than dosage errors, and allergy and seizure medications were found to have the highest rate of discrepancy.[13] Ultimately, they found that when multiple sources of documentation exist at the time of hospital discharge, medication discrepancies are found.[13] This study showed that the pediatric population may benefit from a more extensive medication history.

The current process for obtaining medication histories before surgery within the PACU at the research site is through nurses. First, the day before surgery, a nurse makes a phone call to briefly go through the medications that the patient is taking. A more thorough history is taken by a nurse on the day of surgery in the preoperative area. Pharmacy was not involved in this

process within the PACU, and medication histories would only be performed by pharmacists on certain units after the surgery and admission to the floor. The purpose of this study was to develop a medication history and reconciliation process and determine the potential impact of implementing pharmacist-performed medication histories in a pediatric PACU on the discrepancy rates at the time of transfer of care and to identify common medication error types.

Design/Methods

This is a pilot study of an evidence-based practice change to introduce a pharmacy employee in the preoperative setting to do a medication history and reconciliation, identify discrepancies before transfer to a patient room, and alert the pharmacy before verification of inpatient orders. This project was conducted by pharmacy interns at C.S. Mott Children's Hospital under pharmacist oversight. Interns met with PACU nursing staff and leadership to discuss project goals and orient the staff to their role within the project. Nursing staff and leadership were very receptive and provided a great deal of support throughout the extent of the project.

Blank medication history and reconciliation forms were designed based on literature review of validated forms used at other institutions (Figures 1A, B and 2). Patients included were inpatient or surgical admissions with an age of older than 2 years and younger than 18 years. Patients who were admitted to an intensive care unit from the PACU, patients undergoing cardiac procedures, and patients with surgery end times beyond 3:00 p.m. were excluded. Patients were tracked using a PACU Status Board in the electronic medical record portal. The Status Board provided live updates of a patient's stage in surgery, allowing us to know when a patient would be in the PACU. Interviews were conducted with the patient's parent(s)/guardian(s) while the patient was in Phase 1 recovery, after the Status Board indicated that the patient's family had been paged.

Parents and/or guardians were asked about their child's prescription and over-the-counter medication use, as well as allergy information and adherence. Information that was collected from parents was compared with what was on the patient's electronic medical record. Once a discrepancy was identified, the results were recorded and documented as a pharmacy note in the patient's medical record. Inpatient pharmacists then had access to the note at the time of order verification and could page doctors regarding discrepancies found. Data were collected regarding the patient's age and surgery type, medication categories, and error classifications. Errors were categorized based on the classification system developed by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP).[14] In this system, errors are categorized from A (least severe) to I (most severe).[14] Because of the exploratory nature of the project, only descriptive statistical measures were calculated.

Results

Patient and Pharmacist Response

Families and nurses were generally receptive to pharmacy presence within the PACU. There are multiple phases of postoperative care. During the initial phase (Phase I), patients are often sedated, and families are not called to the bedside until the patient begins to reorient himself or herself. During the second phase (Phase II), patients are prepared for discharge or transport to the general care unit. We found that the best time to approach families was during Phase I, as patients are often in this phase for a longer period than Phase II and parents and/or guardians are often more accessible while waiting for their children to fully awaken from anesthesia, per PACU protocol. Family members generally wanted to spend time with the recovering patients, but they were willing to take some time to provide a history. Although some parents and/or guardians initially seemed confused by the medication history process, explanations by pharmacy interns and nurses helped ease their concerns. In addition, from verbal feedback, pharmacists reported that having medication histories available at the time of order verification was useful.

Interviews and Errors

During the course of 22 days (ranging from June to July 2016), 75 medication histories were performed. On average, three to four medication

A

MEDICATION HISTORY INTERVIEW TOOL

Date: Interview Start Time: Interview End Time:

Patient Name: DOB: Wt (kg): Ht (cm):

Sex: M F MRN: Surgery Type:

SSN (Last 4 digits):

Date of Patient Admission: Date of Surgery:

Interviewee Relation to Patient: PARENT CAREGIVER OTHER:

Outpatient Pharmacy and Contact Information:

Primary Care Provider and Contact Information:

Tea or coffee intake: Y N

History of Clotting Disorders: Y N Clotting Risk Score (from medical record):

Personnel Performing Interview: Circle: INPATIENT or SURGERY ADMIT

Allergy Source (medications, foods, dyes, gluten, etc.)	Reaction	Allergy Source (medications, foods, dyes, gluten, etc.)	Reaction
1.		4.	
2.		5.	
3.		6.	

TO REVIEW MEDICATIONS: print current AMB medications list and use this to verify. If any medications are not in the list, use chart on next page to record. Make sure to go over medication name, strength, dosage form, formulation, dose, frequency, administration, duration, indication, last dose, and source of information.

B

Medication Name, Strength, Dosage Form/Formulation Please include any prescription and over the counter medicines (including vitamins, minerals, and herbal supplements). Also include any medications held for the procedure.	Dose How much is the patient taking? (number of tablets, capsules, units, liquid:dose by mg or mL)	Frequency How often is the patient taking the medication?	Route of Administration and Instructions Include any administration instructions from the physician, medication vial, and if patient is taking the medication different from how recommended.	Duration of Treatment (include start date)	Indication Why is the patient taking the medication?	Last Dose Taken Indicate the date and time of the last dose taken.	Source of Information
1.							❑ Patient/caregiver ❑ Medication vial ❑ EMR ❑ MAR ❑ PCP ❑ Community pharmacy ❑ Personal medication list ❑ Other:
2.							❑ Patient/caregiver ❑ Medication vial ❑ EMR ❑ MAR ❑ PCP ❑ Community pharmacy ❑ Personal medication list ❑ Other:
3.							❑ Patient/caregiver ❑ Medication vial

Figure 1. (A) The first page of the medication history form, designed based on a literature review of forms used at other institutions. (B) Page 2 of the medication history form.

MEDICATION RECONCILIATION FORM

Date: **Patient Name:** **DOB:** **Wt (kg):** **Ht (cm):**

Sex: M F **MRN:** **Surgery Type:**

Date of Patient Admission: **Date of Surgery:**

Personnel Performing Reconciliation: **Start Time:** **End Time:**

Circle Stage of Care: ADMISSION TRANSFER DISCHARGE

Medication	Medication Class	Type of Discrepancy	Interventions/Recommendations	NCC MERP
1.	❑ CNS Drug ❑ Cardiovascular medications ❑ Anticoagulant/antiplatelet ❑ Antimicrobial ❑ Antidiabetic ❑ Steroidal or hormonal ❑ Analgesic ❑ Fever/cold ❑ GI medications ❑ Allergies ❑ Antihyperlipidemic ❑ Vitamins/minerals/herbals ❑ Antineoplastic ❑ Immunosuppressant ❑ Electrolyte ❑ Asthma/RT medication ❑ Other:	❑ Drug omission ❑ Drug commission ❑ Wrong drug ❑ Wrong route of administration ❑ Wrong formulation ❑ Wrong dose ❑ Wrong frequency ❑ Drug interaction ❑ Drug duplication ❑ Drug unavailable ❑ Possible allergic or adverse drug reaction ❑ Incomplete prescription ❑ Other:		❑ A ❑ B ❑ C ❑ D ❑ E ❑ F ❑ G ❑ H ❑ I
2.	❑ CNS Drug ❑ Cardiovascular medications ❑ Anticoagulant/antiplatelet ❑ Antimicrobial ❑ Antidiabetic ❑ Steroidal or hormonal	❑ Drug omission ❑ Drug commission ❑ Wrong drug ❑ Wrong route of administration ❑ Wrong formulation		❑ A ❑ B ❑ C ❑ D ❑ E ❑ F

Figure 2. Medication reconciliation form, with areas for patient demographics, medication categories, error types, and error classification.

histories were performed per project day (3.41 ± 1.27). This covered 44.6% of all eligible surgical cases within the project period. The average age of patients was 9.64 (±4.80) years, and the average time per interview was 9.5 (±2.48) minutes.

A total of 74 discrepancies were found (Figure 3). The average number of discrepancies per patient was 2 (±1.20). The most common type of discrepancy was omission of medications (62%). Other discrepancies included incorrect regimen (18%), medication commission (14%), incorrect formulations (4%), incorrect allergy information (1%), and other miscellaneous errors (1%). The most common medication categories with errors were vitamins/herbals/supplements (42%), allergy medications (15%), and gastrointestinal medications (11%). Other categories of medications included central nervous system medications (7%), steroids and hormones (6%), respiratory medications (6%), antimicrobials (4%), cardiovascular medications (3%), antiemetics (1%), anticoagulants and antiplatelets (1%), analgesics (1%), and other miscellaneous medications (2%). Using the error classification system developed by the NCC MERP, the most common error category was category C (70%), meaning an error occurred that reached the patient but did not cause harm. There were also errors in category A (19%), meaning events had the potential for error, but an error did not occur, and category B (11%), meaning an error occurred but did not reach the patient.

Discussion

The workflow designed in this pilot project was successful in assessing the frequency and type

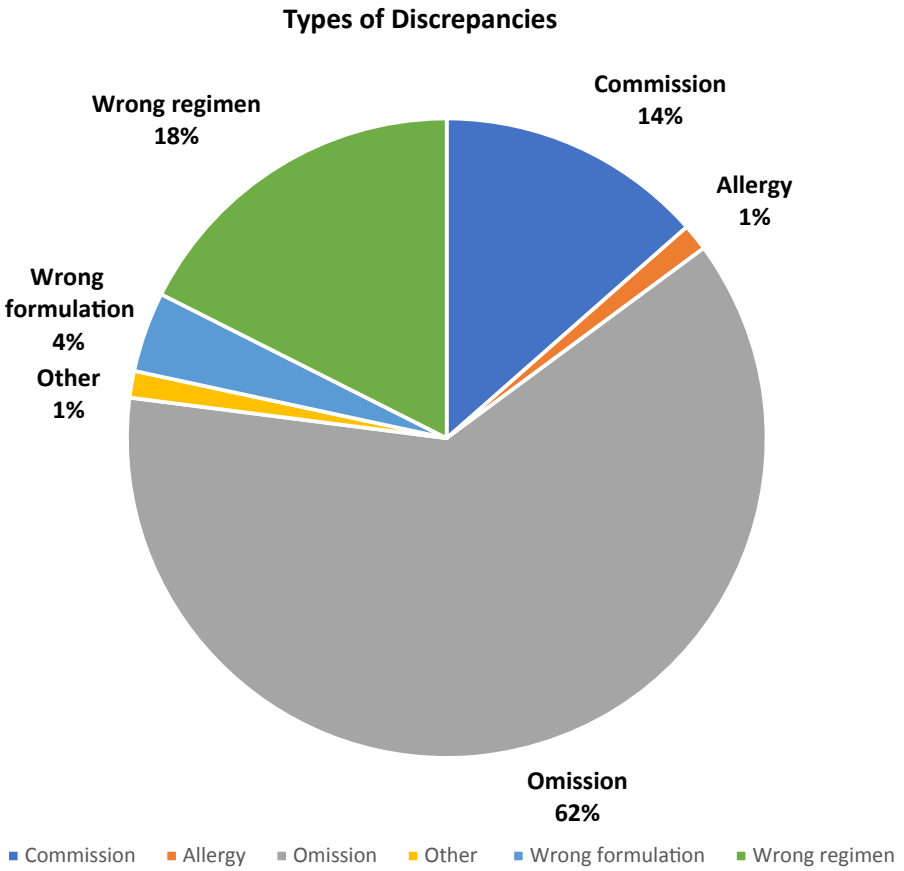

Figure 3. Types of medication discrepancies found. The most common category of errors was medication omission (62%). This figure is available in color online at www.jopan.org.

of discrepancies in medication lists in surgical patients when transitioning from the PACU to the general care unit. The results of this project were similar to other studies in the area of medication history and reconciliation. We found that medication histories performed by pharmacy personnel led to the discovery of discrepancies that were not caught previously by other health care professionals. It was found that vitamins, herbals, and supplements had the most discrepancies. We theorize that the reason for omission of many vitamins, herbals, and supplements is because parents do not consider these products as active medications and do not mention them unless probed. The most common type of discrepancy was omission of medications. This type of error is category C in the NCC MERP classification, meaning that an error occurred that reached the patient but did not cause patient harm.

Limitations

Patient stay times in the PACU were highly variable, and some patients had very short recovery periods. The short time frame and frequent changes in patient location sometimes made locating patients difficult. We were thus not able to conduct histories on all eligible patients. The project was also conducted over a short timeframe (22 days). Additionally, pharmacy interns were only available in the daytime on weekdays to conduct histories. Patients who had late surgery end times therefore did not have histories performed. A final limitation was that parents and/or guardians were not always familiar with their child's medications, thus leading to potential inaccuracy in these medication reconciliations. We recommend that subsequent endeavors incorporate more calls to community pharmacies based on preferred pharmacies listed in the patient's

medical records and clarified with parents and/or guardians during medication histories. It would also be beneficial for parents and/or guardians to bring all their child's medications with them to the hospital for review.

Conclusion

Our pilot project found that medication histories performed by trained pharmacy personnel in the PACU were able to uncover discrepancies in patient medical records before transfer to hospital beds.

Future Directions

The medication history process can be made more efficient by developing clear protocols and training procedures. There are also opportunities to streamline the medication history procedure. For example, instead of using blank forms to conduct medication histories, a medication list in the electronic medical record allowed for smoother history taking. In addition, appropriate documentation of medication history completion for a patient must be ensured to prevent multiple histories being performed in the PACU and on the general care floor at a given stage of care. We do recommend that a new history and reconciliation be performed by either a trained pharmacy personnel or a nurse with each transfer of care. Another area for further research is to examine patient records to see if interventions were made based on medication histories conducted. To formally gauge pharmacist response, a survey could be distributed to inpatient pharmacists to find out if they used the medication history notes and what interventions they made. A final endeavor is the establishment of a permanent pharmacy technician or intern position in the PACU to perform histories. This project paves the way for a permanent pharmacy presence within the PACU.

Acknowledgments

The authors thank the staff of the C.S Mott PACU for their cooperation and coordination on this project.

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