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Challenges of Diabetes Management and Medication Reconciliation

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The Cases

Case #1: *A 53-year-old man was admitted to the medical intensive care unit (MICU) with hypoglycemia and encephalopathy. An accurate medication history was not obtained during his admission, and the inpatient team was unaware that the patient was taking insulin at home. When the patient was discharged, the summary notes stated that he was to "resume home diabetic regimen," but insulin was not included in the discharge medication list. The patient was readmitted 10 days later with another episode of severe hypoglycemia and a humeral fracture caused by a fall. During this admission, the medication history included "insulin aspart 20 units with food and insulin glargine 75 units every morning."*

Case #2: *A 68-year-old woman with type 1 diabetes was admitted for elective total knee arthroplasty. The patient was seen in the preoperative assessment clinic prior to admission, where the nursing staff at the clinic obtained an accurate medication history regarding the patient's diabetic regimen. However, they did not enter this information into the electronic health record (EHR). On admission, the orthopedics fellow ordered insulin aspart 20-30 units three times daily with meals from the patient's home medication list in the EHR. However, when the nurse in the post-anesthesia care unit (PACU) double-checked the dose with the patient before administering, she stated that the ordered dose was much higher than her usual dose. The order was canceled and sliding scale insulin was ordered instead. The preoperative medication history was reviewed and listed her dose as regular insulin 5 units subcutaneously 30 minutes before meals.*

The Commentary

By Samson Lee, PharmD, BCACP, and Mithu Molla, MD, MBA

Importance and Impact of Medication Reconciliation

Medication errors are a major patient safety concern as patients move across various levels of care and care settings. Failure to reconcile medications across transitions of care (TOC) is an important source of potential harm to patients.[1] Up to 67% of inpatients have at least one error in their prescription medication history at the time of admission.[2] When these discrepancies are unintentional and unresolved, they may result in harmful adverse drug events (ADEs), increased length of stay, and subsequently increased health care costs. Medication reconciliation has been recognized by The Joint Commission (TJC) and Institute for Healthcare Improvement (IHI) as a process that can improve communication and reduce medication errors. Medication reconciliation has been shown to reduce the rate of ADEs and healthcare resource use after discharge from the hospital.[3]

The IHI defines medication reconciliation as the formal process of collecting and maintaining a complete and accurate list of a patient's current medications (i.e., a medication history, or pre-admission medication list [PAML]) and comparing that list to the prescribing clinician's admission, transfer, and discharge orders to rectify any discrepancies before patient harm occurs.[4] Medication reconciliation is especially important for vulnerable patient populations who are often on multiple or high-risk medications, such as patients with diabetes.

When a root-cause-analysis approach is applied to the cases cited above, errors in obtaining accurate medication lists can originate at the level of the individual provider but also result from systems-based barriers. This commentary focuses on interventions that can be applied to the individual as well as systems-based interventions that can limit ADEs in patients with diabetes.

Interventions at the Level of the Provider

Obtain an Accurate Medication List

In the first case, the failure to obtain an accurate PAML resulted in a downstream ADE with significant harm (i.e., humeral fracture). Unfortunately, it is not uncommon to have discrepancies between the patient's home medication list and hospital admission orders. In a prospective observational study of 180 general medical inpatients from two academic medical centers, 939 unintentional medication discrepancies were identified. Of these 939 errors, 682 (73%) were deemed not to have potential for patient harm, but 257 (27%) had potential for harm, an average of 1.4 potential adverse drug events per patient. Fifty-nine of these events (23%) were considered serious, i.e., to have potential to cause serious harm such as re-hospitalization or persistent alteration in health function.[1] The majority of potential ADEs occurred at discharge and most of the errors were due to omission.[1]

Especially for high-risk medications, the absence of information can lead to missed opportunities to optimize care. For example, in the case described above, patient's home insulin regimen was not adjusted or discontinued during his first inpatient stay for hypoglycemia. Accurate reconciliation of the patient's home insulin regimen could have prevented the subsequent readmission. Also, an individualized diabetes care plan and education on the appropriate use of insulin therapy at discharge might have led to the discovery of the error. Referral to a diabetes educator or ambulatory care pharmacist for close follow-up after discharge is appropriate for any patient admitted with severe hypoglycemia or hyperglycemia, given that these patients are typically discharged on different medication doses than they were taking prior to admission.

Best Practices for Medication Reconciliation

The process of medication reconciliation is complex, and practices have yet to be widely accepted and disseminated. In 2010, the AHRQ-funded Multi-Center Medication Reconciliation Quality Improvement Study (MARQUIS) was conducted to develop a toolkit of recommendations for medication reconciliation.[5] The research team utilized current literature, expert opinion, and available examples to formulate the MARQUIS toolkit, which emphasized high-performance behaviors when conducting the best possible medication history (BPMH). Some of these best practices include:

- Use at least two different sources of information in compiling BPMH
- Resolve any discrepancies between sources
- Use probing questions
- Ask the patient open-ended questions
- Ask about adherence[6]

In the case of the patient admitted with hypoglycemia and encephalopathy, the patient was likely not able to recall specific details of his home medication regimen. Using two sources of information (ideally the patient and one "objective" source such as pharmacy fill history), the care team may have identified that the patient was on insulin prior to admission. Comparing the PAML to the prescribing clinician's admission, transfer, and discharge orders would have helped to identify discrepancies. The level of detail a patient or caregiver provides about medications is highly variable based on how questions are asked. Utilizing probing and open questions helps interviewers gather additional information. For example, asking "what medications do you use for your diabetes?" can help elicit additional information for non-oral medications, non-daily medications, as-needed medications, or non-prescription medications. For each medication, a team member should ask how often and when the patient takes it.

Tips for Diabetes Management

Medication reconciliation is important to minimize ADEs for everyone, but especially for patients with diabetes. In a retrospective cohort analysis of 31,689 patients with diabetes, having some or all versus no diabetes medications reconciled was associated with a lower risk of ED visits or hospitalizations (rate ratio 0.94 [95% CI 0.90-0.98] vs. 0.92 [0.89-0.95], respectively). The introduction of feedback to individual providers was associated with a significant increase in the odds of all diabetes medications being reconciled (2.63 [2.52-2.75]).[7] Various approaches may be adopted to obtain detailed information about patients' diabetes regimens. For example, ask *how* the patient checks their blood sugars instead of "*do* you check your blood sugars?" Asking open-ended questions may help team members to obtain important information on affordability and access to testing supplies. It may also be helpful to inquire what medications a patient is taking based on the route, for example, "what medications do you take by mouth for your diabetes? What medications do you inject, if any?" It may be helpful to inquire how the patient addresses hypoglycemic episodes to understand their need for glucose tablets or education. If a patient is suspected to be on sliding scale insulin, it is important to clarify and document how the patient uses the sliding scale in case adjustments are needed.

Systems-based Interventions

Hypoglycemia is most common among older patients with multiple or advanced comorbidities, patients with long diabetes duration, or patients with a prior history of hypoglycemia. Clinical decision support tools may help identify at-risk patients and there is emerging evidence that supports multidisciplinary interventions including treatment de-intensification, diabetes self-management, and social support.[8]

Intervention bundles that couple clinical decision support tools, for example, with provider education may help prevent hypoglycemia. Below are additional recommendations that can be employed at the health systems level:

Hire and Train Staff Dedicated to Perform a BPMH

Medication reconciliation is resource-intensive and time-consuming. The process may take 10-90 minutes depending on the patient (e.g., geriatrics, multiple chronic disease conditions, use of different healthcare institutions, poor cognition, availability of family/caregivers) and phase of care (admission or discharge).[9] Advanced age, polypharmacy, and dementia are some risk factors for hypoglycemia. Geriatric patients with multiple medical morbidities and high-risk medications, such as anticoagulants or hypoglycemic medications, may take additional time to clarify and confirm with staff that has dedicated time and training to perform these critical steps adequately. In the MARQUIS study, five US hospitals implemented one to seven evidence-based interventions for 791 patients during the 25-month implementation period. One of the interventions associated with significant decreases in potentially harmful discrepancy rates involved training and hiring staff to perform discharge medication reconciliation.[10] Inaccurate PAMLs that are obtained on admission, if not corrected during the patient's hospitalization, have the potential to lead to ADEs after discharge. Ideally, dedicated pharmacists perform medication reconciliation at critical points during hospitalization, including admission, transitions of level of care (e.g., ICU to floor), and discharge. However, this practice may not be feasible for some hospitals, so hospitals should first focus on hiring and training dedicated staff (usually pharmacists) to assist with medication reconciliation at discharge.[11]

Hiring additional pharmacy staff to perform medication reconciliation may pose significant financial barriers, but interventions that reduce medication discrepancies by at least 10% could cover the cost of the initial intervention.[12] A return-on-investment calculator can be downloaded from the Society of Hospital Medicine website including the cost of pharmacy full-time employees (FTE).[13] Focusing intensive pharmacy-led medication reconciliation efforts on high-risk patients, such as those with diabetes, may allow optimal use of this resource. At our institution, an EHR-based risk stratification tool is used to identify high-risk patients on admission (such as patients with diabetes) and thereby direct pharmacist-led medication reconciliation. In case 1, at any point during the patient's hospitalization, pharmacy staff with dedicated time to perform a BPMH could have then transmitted the information to the treating physicians, who could make informed recommendations on discharge.

There are many resources available to train staff from varied disciplines on how to perform a BPMH. Interestingly, the MARQUIS data demonstrates that training staff to perform BPMHs was shown to be detrimental. Some possible factors that could have influenced these results include: 1) training personnel on this task without certification of competency may not sufficiently improve their skills; 2) training personnel without sufficient time to perform the task well (e.g., frontline nurses with many other responsibilities) may be counterproductive compared with training a few personnel with time dedicated to

the task; and 3) training existing personnel in history-taking may have delayed the necessary hiring of more staff to take BPMHs.[10] The importance of adequately performing BPMH should be coupled with observation and evaluation, ideally through a certification process where providers can be assessed while taking a BPMH and their skills evaluated.

Define Clinical Roles and Responsibilities

In addition to hiring and training staff dedicated to performing BPMH, the MARQUIS study showed that defining clinical roles and responsibilities also led to a reduction in harmful discrepancies.[10] Health systems may face barriers to implementing an effective medication reconciliation protocol due to insufficient engagement or prioritization. There also may be a lack of consensus on who is responsible for managing the medication list, professional training, and/or dedicated resources. A prior qualitative study described confusion related to clinicians' roles and responsibilities during medication reconciliation; clear delineation should reduce unnecessary repeat work and improve the medication reconciliation process.[14] Providers should have dedicated time to perform a BPMH unique from other roles or responsibilities with pharmacists, ideally suited for this role. The involvement of a pharmacist as part of the multidisciplinary team in the surgical preadmission clinic has been shown to improve patient safety during hospital admission.[15]

Additionally, there may be challenges related to providers accessing the EHR. Medication information can be stored in various parts of an EHR due to the fragmented architecture of the system.[16] In case 2, the nursing staff at the preoperative assessment clinic obtained an accurate medication history regarding the patient's diabetic regimen but did not enter this information into the EHR. This failure likely stemmed from unclear expectations regarding their role in accessing and modifying the medication lists within the EHR. Organizational policies may impede this critical step. For example, health factors that could have influenced these results. Health system policy may limit changes to the PAML to physician providers only. Expanding policies and protocols to include non-physician providers who can update the EHR may be critical in maintaining an updated PAML that all providers may access during the patient's care. In case 2, dedicated pharmacy staff at the preoperative assessment clinic would not only be able to obtain an accurate medication history but could also have updated the PAML by assessing and modifying the EHR. Additionally, there is much room for further improvement for EHRs to be easier to use, interoperable with other EHRs, and designed with better user interfaces to minimize redundancy in documentation.[16]

MARQUIS2 was a subsequent study involving 18 medical centers that demonstrated mentored implementation of a refined best practices toolkit, including patient-level and system-level interventions, and was associated with a substantial decrease in unintentional medication discrepancies over time.[17] During the intervention, patients experienced a steady decline in their medication discrepancy rate from 2.85 to 0.98 discrepancies per patient; interrupted time series analysis of the sites with sufficient data showed the intervention was associated with a 5% relative decrease in discrepancies per month over baseline temporal trends. The emphasis in MARQUIS2 was placed on interventions shown to reduce harmful discrepancies, including utilizing dedicated medication history takers, training existing staff to perform discharge medication reconciliation and patient counseling, and clarifying roles and responsibilities among clinical personnel.[18]

Take-Home Points

- Medication reconciliation has been recognized by TJC and IHI as a process that can improve communication and reduce medication errors.
- Medications used to treat diabetes are high-risk medications and may warrant additional time and resources to elicit an accurate history.
- Use at least two different sources of information in compiling BPMH, resolve discrepancies, use probing and open-ended questions, and ask about adherence.
- Dedicated pharmacy staff can help reduce medication errors on discharge.
- Clear delineation of roles and responsibilities regarding medication reconciliation is necessary at the institution level, to avoid unnecessary effort and reduce errors.

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References

1. Pippins JR, Gandhi TK, Hamann C, et al. Classifying and predicting errors of inpatient medication reconciliation. *J Gen Intern Med*. 2008;23(9):1414-1422. [Free full text]
2. Tam VC, Knowles SR, Cornish PL, et al. Frequency, type and clinical importance of medication history errors at admission to hospital: a systematic review. *CMAJ*. 2005;173(5):510-515. [Free full text]
3. Al-Hashar A, Al-Zakwani I, Eriksson T, et al. Impact of medication reconciliation and review and counseling, on adverse drug events and healthcare resource use. *Int J Clin Pharm*. 2018;40(5):1154-1164. [Free full text]
4. Medication Reconciliation Review. *Institute for Healthcare Improvement*. www.ihi.org. http://www.ihi.org/resources/Pages/Tools/MedicationReconciliationReview.aspx Accessed July 25, 2022.
5. ?Mueller SK, Kripalani S, Stein J, et al. A toolkit to disseminate best practices in inpatient medication reconciliation: multi-center medication reconciliation quality improvement study (MARQUIS). *Jt Comm J Qual Patient Saf*. 2013;39(8):371-382. [Available at]
6. MARQUIS Investigators. MARQUIS Implementation Manual.; 2022. https://www.hospitalmedicine.org/globalassets/clinical-topics/clinical-

pdf/shm_medication_reconciliation_guide.pdf. Accessed June 11, 2022.
7. Turchin A, Sosina O, Zhang H, et al. Ambulatory medication reconciliation and frequency of hospitalizations and emergency department visits in patients with diabetes. *Diabetes Care*. 2018;41(8):1639-1645. doi:10.2337/dc17-1260. [Free full text]
8. Silbert R, Salcido-Montenegro A, Rodriguez-Gutierrez R, et al. Hypoglycemia among patients with Type 2 diabetes: epidemiology, risk factors, and prevention strategies. *Curr Diab Rep.*; 18(8): 53. [Free full text]
9. Meguerditchian AN, Krotneva S, Reidel K, et al. Medication reconciliation at admission and discharge: a time and motion study. *BMC Health Serv Res*. 2013;13:485. [Free full text]
10. Mueller SK, Sponsler KC, Kripalani S, et al. Hospital-based medication reconciliation practices: a systemic review. *Arch Intern Med.* 2012;172(14):1057-1069. [Free full text]
11. Mixon AS, Kripalani S, Stein J, et al. An on-treatment analysis of the MARQUIS study: interventions to improve inpatient medication reconciliation. *J Hosp Med*. 2019;14(10):614-617. [Free full text]
12. Najafzadeh M, Schnipper JL, Shrank WH, et al. Economic value of pharmacist-led medication reconciliation for reducing medication errors after hospital discharge. *Am J Manag Care.* 2016;22(10):654-661. [Free full text]
13. Medication reconciliation for hospitalists. *Society of Hospital Medicine*. https://www.hospitalmedicine.org/clinical-topics/medication-reconciliation. Accessed June 11, 2022.
14. Vogelsmeier A, Pepper GA, Oderda L, et al. Medication reconciliation: a qualitative analysis of clinicians' perceptions. *Res Social Adm Pharm*. 2013;9(4):419-430. [Available at]
15. Kwan Y, Fernandes OA, Nagge JJ, et al. Pharmacist medication assessments in a surgical preadmission clinic. *Arch Intern Med*. 2007;167(10):1034-1040. [Free full text]
16. Jylhä V, Saranto K. Electronic documentation in medication reconciliation - a challenge for health care professionals. *Appl Nurs Res*. 2008;21(4):237-239. [Available at]
17. Schnipper JL, Reyes Nieva H, Mallouk M, et al. Effects of a refined evidence-based toolkit and mentored implementation on medication reconciliation at 18 hospitals: results of the MARQUIS2 study. *BMJ Qual Saf*. 2022;31(4):278-286. [Free full text]
18. Mixon AS, Smith GR Jr, Mallouk M, et al. Design of MARQUIS2: study protocol for a mentored implementation study of an evidence-based toolkit to improve patient safety through medication reconciliation. *BMC Health Serv Res*. 2019;19(1):659. [Free full text]

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