Medications at Transitions and Clinical Handoffs (MATCH)

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2. **Structured Abstract** (200 words maximum). Include five headings: Purpose, Scope, Methods, Results, and Key Words

Purpose: The purpose of this project was to implement a process for medication reconciliation at Northwestern Memorial Hospital and to evaluate the effectiveness of the intervention.

Scope: We implemented medication reconciliation on the medical service and studied 651 patients to ascertain risk factors for discrepancies.

Methods: Study pharmacists obtained a list of all general medicine service admissions on a daily basis from admitting registration data. Patients reporting low English proficiency on registration were prioritized for study interviews, then all remaining patients were randomized. All interviews were conducted within 24-48 hours of admission.

Results: The mean age of patients in this study was 56.8 years old (range, 18-101 years), and 93% reported English as their preferred language. We identified 442 patients with a total of 1456 discrepancies between physician- and pharmacist-obtained medication histories. The most common discrepancy was a medication omission. Excluding vitamins and supplements, cardiovascular agents were the most common discrepant drug class. An assessment of medication-related risk factors was performed on 428 patients. The number of home medications was a significant risk factor for patients with discrepancies in their medication histories compared with those without ($p<0.0001$). Patients without discrepancies took an average of 5.4±3.5 medications prior to admission compared with 9.8±5.1. No other potential risk factors for medication discrepancies were noted to be significant. Patients who kept a written list of their medications experienced fewer discrepancies in their medication histories compared with patients who did not provide a medication list ($p<0.001$).

Key Words: medication reconciliation, medication errors, adverse drug events, health literacy, medication safety

3. **Purpose** (Objectives of the study)

It has been estimated that, in the US alone, medication errors cause 7000 or more deaths per year.[1] Nearly 40% of medication errors occur in the prescribing phase,[2] and studies have demonstrated that there is an increased risk of error during handoffs at admission, transfer to another unit, or discharge,[3,6-8] also referred to as "interfaces of care."[6] Additionally, it is becoming more common to utilize hospitalists, physicians who focus on the care of hospitalized patients,[9] and thus information transfer during handoffs from the primary care physician to the hospitalist and then back to the primary care physician upon discharge may pose an additional risk for safe care.[10-11] At each of these interfaces or transition points, coordination and clear communication between multiple members of the healthcare team, including the patient, are critical to ensure continuity and patient safety.

Obtaining medication histories is a challenging, high-risk, error-prone activity. Usually, interviews take place within the first 24 hours of admission, a vulnerable time for patients due to their compromised health status and stress of being hospitalized. Many other factors can affect the quality of the medication history information obtained, such as language and cultural barriers. Patients may see multiple physicians or may utilize multiple pharmacies due to economic, insurance, and/or convenience factors, which creates challenges, as no one physician or pharmacy may have a complete record of the patient's treatment regimen. Patients taking a large number of medications may not be able to recall all therapies and doses. Look-alike/sound-alike medications may increase risk of an inaccurate history, especially if patients are unclear about the rationale for use.[3,12] Time constraints and interview skills of the clinician, as well as the relationship the patient has with the person obtaining the history, may also affect the quality of the medication history.

Patients or their surrogates may be poor historians or may withhold information on medication usage or compliance. Based on reports by the Institute of Medicine (IOM)[13] and AHRQ,[14] as many as 90 million Americans may be affected by low health literacy (health literacy is defined as the ability to understand basic healthcare information, such as prescription labels, test results or medical forms), and this may adversely affect patient outcomes.[15-18] Many patients with low health literacy are ashamed and may hide their difficulties in understanding healthcare instructions.[19] Therefore, utilizing effective screening methods to identify such patients,[20] as well as improving patient-provider communication and patient educational interventions, is essential.[21]

If patients are unable to provide medication histories, other resources may be available. One strategy is to seek technology to access past medical records electronically, but medication lists may lag behind physician notes, or documentation may be missing or incomplete.[22] Labels on prescription bottles or outpatient pharmacy records may not accurately reflect patients' current

regimens, and the patients' usage of over-the-counter drugs, herbals, and dietary supplements may not be documented.

The objectives of the study were:

(1) To implement the MATCH program, utilizing an integrated, multidisciplinary process to improve medication reconciliation.

(2) To analyze the implementation of MATCH to assess the acceptability of and compliance with new medication reconciliation procedures.

(3) To determine the rate and etiology of medication reconciliation failures within the general medicine service.

(4) To identify risk factors frequently responsible for inaccurate medication reconciliation.

(5) To produce and disseminate a toolkit based on MATCH that other acute care hospitals can use to implement programs to reduce medication reconciliation failures.

4. **Scope** (Background, Context, Settings, Participants, Incidence, Prevalence)

Studies have shown that pharmacist-obtained medication histories result in increased accuracy and fewer medication errors due to their education, experience, medication knowledge, and patient-counseling skills.[4,23-25] However, at most US hospitals, pharmacists conduct a medication history only 5% of the time,[23] despite findings of one study showing that over 70% of drug-related problems were recognized only through a patient interview by a pharmacist[26] and another study reporting a 51% reduction in medication errors when pharmacists were involved in obtaining histories.[23] Additionally, both the National Quality Forum (NQF) and AHRQ recognize the importance of pharmacists actively participating in the medication-use process, such as during the ordering and monitoring phases, as well as being available for consultation.[27-29]

Although obtaining a medication history is a significant component of the pharmacist's expertise, the national shortage of pharmacists, workflow design, and nonclinical responsibilities, such as dispensing, may limit the availability of pharmacists in the hospital setting to participate in this process for all patients. Typically, nurses are the first healthcare professional to interact with patients upon admission, and they spend more time with the patient throughout the hospitalization than other healthcare providers do.[30] Therefore, medication histories are primarily performed by the nurse and/or the physician caring for the patient.

Physicians and nurses typically receive little formal education about obtaining medication histories. They often rely on clinical rotations to gain experience and

develop interview skills. There is evidence that “accurate and complete” medication histories result from proactive, organized involvement of the entire team of healthcare professionals to obtain and validate this information.[6-7,31-32] This is an important step upon hospital admission, as histories form the basis for the patient’s initial treatment plan, which is then tailored according to the patient’s clinical status throughout the hospital stay and at discharge. Medication reconciliation is defined as a systematic validation and verification process to ensure accuracy and continuity in the patient’s medication regimen from pre-hospital care through admission, transfer, and discharge to the next setting.[3,33]

There is evidence that medication reconciliation is an effective and safe practice to reduce medication errors and the potential for patient harm. In a 7-month period, Rozich and colleagues[34] found that medication errors were reduced from 213 per 100 admissions to fewer than 50 per 100 admissions when medication histories and orders were reconciled at admission, transfer, and discharge. A study of admission medication reconciliation found that, in the absence of a pharmacist intervention, 22% of the discrepancies could have resulted in patient harm during hospitalization, and 59% may have resulted in patient harm if the error continued beyond discharge.[4] Pronovost and colleagues[35] reported a reduction in medication errors from 94% at baseline to essentially zero within the first 24 weeks of implementing medication reconciliation on patients discharged from their surgical intensive care unit. Additionally, their reconciliation process also helped ensure that antihypertensives were prescribed at discharge in appropriate patients. Both NQF[27] and AHRQ[28-29] have endorsed the patient safety practice of prescribing beta blockers to improve outcomes in patients undergoing surgery who are at high risk for cardiovascular complications. Medication reconciliation may also help build the process steps necessary to comply with NQF and AHRQ recommendations, such as ensuring that information is transferred in a timely fashion between all healthcare providers in an accessible and understandable manner.[27,29,36]

Several state-based organizations are emphasizing the need to adopt medication reconciliation as a safe practice. The Massachusetts Coalition for the Prevention of Medical Errors promotes medication reconciliation as a best practice for hospitals.[33] Through funding from AHRQ, the coalition has instituted a statewide patient safety program on medication reconciliation to assist hospitals to establish this process within their institution and share strategies and lessons learned. The Illinois Hospital Association (IHA), representing more than 200 hospitals and health systems within the state, is also instituting a similar collaborative on reconciliation.[37] Northwestern Memorial is serving as a member of the advisory group and faculty to help IHA develop its statewide learning model. In South Carolina, healthcare organizations are promoting a universal medication form to encourage patients to keep track of their medication and allergy information and reconcile this information at every healthcare encounter.[38] The Institute for Healthcare Improvement (IHI),[39] a Massachusetts-based organization focused on improving the quality of healthcare, promotes medication reconciliation through its patient safety

collaboratives. By collaborating with the IHI to implement a medication reconciliation process**,** the OSF Healthcare System increased its admission reconciliation accuracy rate from 40% to almost 95%.[40]

From 1995-2003, the most common root causes of sentinel events reported to The Joint Commission (formerly, JCAHO) were attributed to communication, followed by orientation and training.[41] Additionally, data from US Pharmacopeia's national MedMARx system,[42] a comprehensive, internet-accessible, and anonymous medication error reporting program, has also demonstrated that poor communication is a significant contributor to medication errors. To support member organizations in monitoring and evaluating medication reconciliation processes, MedMARx has added "reconciliation-admission," "reconciliation-transition," and "reconciliation-discharge" as choices within its database's "cause of error" field.[42]

Our project was completed at Northwestern Memorial Hospital, an 825-bed academic medical center in Chicago, Illinois. Due to the complexity of implementing medication reconciliation, we focused our efforts on patients admitted to the general medicine service at Northwestern.

5. **Methods** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations)

To implement medication reconciliation, we developed a single (shared) medication history list generated upon admission to identify and resolve inconsistencies or discrepancies. The physician was accountable for reconciliation upon admission. Nursing and pharmacist support was available as required to facilitate completion of the admission reconciliation, consistent with work flow and professional roles. There were many legitimate reasons for not continuing medications, and the rationale for purposeful inconsistencies was documented within the EMR.

Once medication reconciliation was implemented, research pharmacists obtained a list of all general medicine service admissions on a daily basis from admitting registration data. Patients reporting low English proficiency on registration were prioritized for study interviews; then, all remaining patients were randomized utilizing the random number assignment function in Excel to produce a list. Patients were approached in order with the goal of interviewing approximately 5-6 patients daily (Monday-Friday) until study goals were completed. All interviews were conducted within 24-48 hours of admission to the general medicine service in patient's rooms (all private rooms) to maintain confidentiality.

The research pharmacist inquired about all medications the patient used prior to admission. This interview also included an assessment of "as needed," nonprescribed, topical, and herbal/supplemental products taken. For patients with limited English proficiency (i.e., patients with English as a second language

and/or patients with a limited ability to speak, read, write, or understand the English language), a telephone foreign language interpreter service contracted by the hospital was utilized by the research pharmacist per hospital policy and standard of care at Northwestern. The use of a dual-handset or a speakerphone facilitates a three-way conversation between the telephone interpreter, the patient, and research pharmacist about the patient's medications. At the end of the interview, the research study pharmacist asked the patient if they would be willing to participate in a further risk factor assessment interview by a research assistant (RA). If the patient agreed to participate, the RA was introduced and asked for written informed consent and HIPAA authorization to review their medical records. The RA administered the Short Test of Functional Health Literacy in Adults (S-TOFHLA) and the Mini-Mental Status Exam (MMSE).

The research pharmacist's medication history was compared with the physician's medication history and current orders to determine a) *history discrepancies*, defined as any difference noted between the physician-obtained medication history compared with the pharmacist-conducted interview, and b) *history/order discrepancies*, defined as any difference noted between the patient's admission medication orders and medication history.

The type, frequency, and severity of medication discrepancies identified during medication reconciliation upon admission were assessed. All medication orders that were clarified with the ordering physician and that resulted in changes were assessed for their potential severity by a research pharmacist and then rated independently by a research physician. Any disagreements on potential severity were discussed, and consensus was reached. The severity was analyzed utilizing the 9-point index for categorizing the severity of medication errors, developed by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP). Severity was assessed in the current state (i.e., if the clarification did not occur during hospitalization). The potential longer-term risk was also assessed if the error continued for 2 weeks post-discharge, a common timeframe before most patients visit their next provider of service after hospital discharge; this could potentially be the first opportunity to identify and resolve a discharge medication reconciliation failure.

6. **Results** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications)

Our results are divided into two sections. The first addresses the implementation of medication reconciliation, and the second discusses the research findings.

In order to implement medication reconciliation, a multidisciplinary team is required. This team may be exactly the same as the design team or it may include members that continue on with the project along with new members joining the group. Even though we had to bring new members "up to speed," there may be some advantages to the latter approach:

- Design team members may find it difficult to accept when "their" design isn't working as planned, despite pilot testing.
- New members may be more open to change and may contribute new suggestions for improvement.
- Depending on the scope of the project, additional members, identified through a stakeholder analysis, may be needed to help facilitate implementation.

Moving into the implementation phase requires the development of an implementation charter. This will provide a framework for:

- Defining implementation goals and objectives
- Identifying key metrics for implementation
- Determining implementation resources and support system requirements
- Developing a training curriculum
- Establishing continuous feedback mechanisms for receiving suggestions from and providing follow-up to staff throughout implementation

To successfully coordinate an implementation strategy, mandatory meetings, led by executive sponsors, should be held with stakeholders representing physicians (i.e., clinical program leaders, departmental chiefs, and chairs) and patient care (i.e., nursing directors, pharmacy director, and pharmacy managers).

During this meeting, implementation plans and training curriculum should be presented. A multidisciplinary training approach (i.e., physicians, nurses, and pharmacists attending training classes together) should be recommended and is encouraged. A number of dates and time periods can be determined based on the needs and availability of various disciplines. Classes can be offered early in the morning, during the day, in the evening, and on weekends to accommodate a variety of schedules.

Just like pilot testing, there are several different strategies to roll out the medication reconciliation process. Depending on the scope of the project and the size of the organization, some implementation strategies may include:

- By unit (e.g., all ICUs)
- By service (e.g., Surgical Services)
- By discipline (e.g., Roll-out process to all physicians, then to all nurses, and then to all pharmacists)
- Hospital-wide, all disciplines

Adherence to an implementation timeline is critical to success. This helps ensure a timely roll out while maintaining flexibility if unanticipated issues arise. Staff should be well informed and given adequate notice regarding training dates and implementation strategies prior to roll out. Staff communication may need to occur through a variety of channels, such as e-mails, brief announcements at

staff meetings, and memos posted in nursing units, report rooms, conference areas, etc.

A more detailed description of our MATCH project can be found on our website at http://www.medrec.nmh.org.

With regard to our research component, our preliminary analysis of 651 patients revealed a mean age of 56.8 years old (range, 18-101 years). Approximately 93% of the patients reported English as their preferred language, with excellent English proficiency. Upon admission, 48.2% of the patients reported their race/ethnicity as White, followed by 35.6% reporting African American, 6.3% reporting Hispanic, 7.4% reporting other race/ethnicities, and 2.5% not reporting.

Four hundred forty-two patients (67.9%) had a total of 1456 discrepancies between physician- and pharmacist-obtained medication histories. Two hundred fifty-five patients (39.2%) had a total of 530 discrepancies in their medication orders when compared with admission histories. Of the 255 patients with order discrepancies, 231 (90.6%) had at least one medication discrepant in their history that led to an order discrepancy requiring clarification (e.g., the discrepancy originated in the history and followed through to the orders). The most common discrepancy in both the histories and orders was a medication omission. When we excluded vitamins and supplements, cardiovascular (CV) agents (21.4%), gastrointestinal (GI) agents (14.2%), nonopiates (5.9%), and anti-diabetic agents (5.7%) were the top four drug classes, in that order, involved in a history discrepancy (n=1133). Excluding vitamins and supplements for history/order discrepancies (n=477), CV agents (31.4%) were still the most common discrepant drug class, followed by GI agents (8.8%), antidepressants (5.9%) and anti-diabetic agents (5.5%).

Accepted interventions (n=367) were assessed for potential harm. There was a 91.5% agreement between pharmacist and physician ratings; disagreements were reached by consensus. In the absence of reconciliation, 10.6% of these discrepancies may have resulted in patient harm during hospitalization, and 66.7% may have resulted in harm if the error continued beyond discharge. A shift to greater harm after discharge would be expected in most circumstances, as less intense monitoring usually occurs compared with the inpatient setting.

An assessment of medication-related risk factors was performed on 428 patients (65.7%). In a multivariable analysis of prescription medications, the number of home medications was a significant risk factor for patients with discrepancies in their medication histories compared with those without ($p<0.0001$). Patients without discrepancies in their medication histories took an average of 5.4±3.5 medications prior to admission compared with 9.8±5.1 medications in patients with potentially harmful discrepancies during hospitalization. No other potential risk factors for medication discrepancies were

noted to be significant. In contrast, patients who kept a written list of their medications, brought their list, and gave it to their physician and/or nurse upon admission experienced fewer discrepancies in their medication histories compared with patients who did not provide a medication list ($p<0.001$).

The Short Test of Functional Health Literacy in Adults (S-TOFHLA) and Mini-Mental Status Exam (MMSE) were performed on 125 patients (19.2%) after written informed consent was obtained. Neither health literacy level nor mental status showed a significant difference for patients with history discrepancies compared with those without. These results may be partially explained by a small sample size and the fact that the S-TOFHLA and MMSE assessments required patient consent; those who were unable to consent were naturally excluded. The effects of health literacy and cognition as risk factors for medication reconciliation failures warrant further study.

In summary, medication discrepancies upon admission were common. Preliminary data suggest that patients on an increased number of medications are at risk for medication reconciliation failures. The presence of a medication list may help prevent discrepancies in patients' medication histories. Also, early identification and correction of medication reconciliation failures may mitigate or prevent patient harm. Our results are consistent with the findings of other researchers and support the patient safety benefits of reconfirming medication histories and performing reconciliation.

7. List of Publications and Products

Books

Gleason KM, McDaniel M. *Medication Reconciliation: Practical Strategies and Tools for Joint Commission Compliance*. Marblehead, MA: HCPro, Inc., 2008.

Conference Proceedings

Gleason KM, McDaniel M, Liss D, Liebovitz D, Feinglass J, Castro G, Rooney D, Barnard C, Baker D and Noskin GA. Medications At Transitions and Clinical Handoffs (MATCH): Risk factors for medication reconciliation failures. Agency for Healthcare Research and Quality (AHRQ) Patient Safety and Health Information Technology Conference: Strengthening the Connections. Washington, DC. June 2006.

McDaniel M, Gleason KM and Noskin GA. Discrepancies among medication histories in a surgical intensive care unit. Agency for Healthcare Research and Quality (AHRQ) Patient Safety and Health Information Technology Conference: Strengthening the Connections. Washington, DC. June 2006.

Gleason KM. Medications At Transitions and Clinical Handoffs (MATCH): The NMH Experience. American Society of Health-System Pharmacists Summer Meeting and Exhibition. Orlando, FL. June 2006.

Gleason KM. Medications At Transitions and Clinical Handoffs (MATCH): Risk factors for medication reconciliation failures. Illinois Council of Health-System Pharmacists Fall Meeting. Oakbrook, IL. September 2006.

McDaniel M, Gleason KM, Liss D, Liebovitz D, Feinglass J, Castro G, Rooney D, Barnard C, Baker DW, Noskin GA. Medications At Transitions and Clinical Handoffs: Preventing Patient Harm and Identifying Potential Risk Factors for Medication Reconciliation Failures. University HealthSystem Consortium (UHC) Quality and Safety Fall Forum. Baltimore, MD. October 2006.

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Schiff G, Gleason KM, Storto S, Claud, RD, Steward B. Medication Reconciliation: Experiences, Challenges and Opportunities. Breakout Session, Chicago Patient Safety Forum Annual Meeting: Patient Safety – Moving from Concept to Reality. Chicago, IL. March 2007.

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Newman D, McDaniel M, Gleason KM, Noskin GA. The Value of Medication Reconciliation in the Management of Patients' Medications at Discharge: Medications At Transitions and Clinical Handoffs (MATCH) Initiative. National Patient Safety Forum Annual Patient Safety Congress. Washington, DC. May 2007.

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McDaniel M. Medication Reconciliation: Improve your Process, Impact Patient Care. National Comprehensive Cancer Network Patient Safety Summit. Chicago, IL. November 2007.

Gleason KM. Medications At Transitions and Clinical Handoffs (MATCH): Improving Your Process, Impacting Patient Care. American Society of Health-System Pharmacists (ASHP) Midyear Clinical Meeting, Medication Reconciliation Networking Session. Las Vegas, NV. December 2007.

Gleason KM, Green ML. Medication Reconciliation: Designing an Approach to Focus on What's Important. Chicago Patient Safety Forum Annual Scientific Meeting: Patient Safety Across the Continuum. Chicago, IL. March 2008.

Electronic Resources and Nonprint Data

MATCH Toolkit www.nmh.medrec.org

Gleason KM, Baker D, and Noskin GA. Medications At Transitions and Clinical Handoffs (MATCH): The NMH Experience. Scottsdale Institute (audio-conference). April 2006.

Gleason KM. Medications At Transitions and Clinical Handoffs (MATCH): Medication Reconciliation Across the Continuum. National Patient Safety Foundation Audio-conference. February 2008.

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