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Implementing Medication Reconciliation: Enhancing Medication Safety and Reducing Errors

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Abstract – ***Background:*** Medication errors are a persistent issue in healthcare, causing adverse drug events (ADEs) and escalating healthcare costs, particularly during patient care transitions. ***Objective:*** This study aimed to assess the effectiveness of implementing medication reconciliation (MR) in reducing medication discrepancies and enhancing patient safety within an inpatient unit over one year. ***Method:*** A cross-sectional observational study was conducted in an inpatient unit over one year, involving 100 patients who met the inclusion criteria. Data were collected at admission, intra-hospital transfer, and discharge, identifying medication discrepancies through structured interviews and chart reviews. Data analysis was performed using SPSS version 26.0, with descriptive and inferential statistics applied. ***Results:*** Medication reconciliation (MR) demonstrated substantial improvements in medication safety. Initially, 72% of patients had discrepancies, including omissions (51%), duplications (22%), incorrect dosages (15%), and frequency errors (12%). Post-MR, total discrepancies decreased by 47%, with the mean discrepancies per patient halving ($p < 0.05$). MR effectiveness extended across all demographics, admission sources, and medication types, with particularly significant impacts in high-risk groups, such as those with chronic illnesses and polypharmacy. Additionally, MR improved patient satisfaction by 15% and reduced medication-related costs by 20%, confirming its value in enhancing both patient safety and healthcare efficiency. ***Conclusions:*** Medication reconciliation is an effective strategy for reducing medication discrepancies and enhancing patient safety, especially during transitions in inpatient settings.

Keywords – Medication reconciliation, inpatient care, medication safety, adverse drug events, medication discrepancies.

INTRODUCTION

Medication safety has become one of the most important priorities in the modern healthcare landscape in recent years, as medication errors are a major threat to patient health, a major reason for hospital readmission, and represent enormous global health expenditure [1]. Medication safety has received attention as one of WHO's Third Global Patient Safety Challenges by the similar study, which aims to reduce the incidence of severe avoidable harm related to medications. Medication Errors: Medication errors, or "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional...or the patient" National Coordinating Council for Medication Error Reporting and Prevention a similar study are among the most common causes of ADEs. Medication errors can happen at any step in the medication management process, including prescribing, dispensing, administering, and monitoring. Within transitions in care, medication reconciliation (MR) has been identified as an essential solution to improve medication safety by identifying and correcting discrepancies with respect to medications used by the patient. Explore the use of MR across clinical environments to reduce errors, improve patient outcomes, and face challenges of successful integration into or for clinical practice rooms. Experience with adverse drug events – especially those related to transitions in care – is well-documented in the healthcare literature. Transition between care, e.g., hospital admission, transfer, and discharge, can be associated with communication failure and lead to patients receiving inappropriate or incomplete instruction on their regimens. Older adults and patients with multiple chronic conditions (who often, but not always, are being prescribed multiple drugs) are often affected disproportionately by these errors [2]. That medication errors occur in half of all transitions of care and result in adverse outcomes including longer hospital stays, higher morbidity and mortality and a greater economic toll. Reconciling patient medication lists and having accurate and complete medication management can reduce ADEs A similar study, therefore, addressing those discrepancies is important. Medication reconciliation is a formalized process in which an accurate and comprehensive medication list is created and continued for each patient as they move

through the health care system. Medication reconciliation (MR) consists of three components: verification, which involves obtaining a complete and correct list of medications; clarification, which refers to the evaluation of medications and their doses for appropriateness; and reconciliation, which refers to the resolve of discrepancies [3]. Through this, MR can help in preventing ADEs that truly can be avoided, improving patient safety, and enhancing continuity of care. Maintaining MR is a critical component of communications between members of the healthcare team, patients, and caregivers, contributing to safer transitions in care. MR has been receiving growing attention, including designation as a National Patient Safety Goal by The Joint Commission. This process is especially important at time to hospitalization and discharge, where medication errors are common due to incomplete or inaccurate medication information [4]. Such as if a patient is discharged and is prescribed medications that were previously prescribed or ordered. Prescribed. In the absence of systematic reconciliation, such discrepancies may traverse a long road of care unnoticed culminating in adverse drug events (ADE) that delay and/or interfere with recovery and/or add to healthcare costs. Medication errors impact healthcare systems across the globe. Globally, nearly 10% of total health expenditure. Highlight the importance of effective medication reconciliation MR in protecting the patient and limiting the burden on healthcare resources. The damage done by MR can be exacerbated in low-resource settings, where health infrastructure may be lacking. MR in hospitals has been associated with a 50% reduction in medication discrepancies, suggesting substantial potential to increase patient safety and health outcomes in a variety of health care settings [5]. In spite of the advantages, the MR has many questions to be spread over a wide front formally. The process is time-consuming and resource-intensive in the first place. In high-demand settings like emergency departments, healthcare providers often do not have the time or training to perform extensive reconciliations. Moreover, the lack of standardized MR protocols among healthcare facilities can apply to variability in the quality and consistency of reconciliation practice. Instead, research on MR is based on incongruous definitions—this contradicts the purpose of MR and renders it difficult to quantify [6]. A third key barrier relates to the necessity of documenting purely manually. With complicated medication regimens, traditional MR processes are person-bound and prone to human error. Whereas each provider within MR may fulfil their respective clinical role, communication gaps can exist which may lead to loss of critical information during transitions of care. Similar to this, an experiment conducted by A similar study found that one of the most neglected areas of care, that is, medication, is often complicated by incomplete transfer of information from one provider to another leading to a medication discrepancy in more than 40% of patients at hospital admission, at least 1 discrepancy. Digital health tools, especially electronic health records (EHRs), have the potential to address some of these challenges by enabling more efficient and accurate MR: digital MR systems can update medication histories at the time of an encounter, enhancing accuracy and minimizing human error and communication failures between healthcare teams [7]. EHR-based MR has been shown to reduce medication discrepancies by as much as 50%, demonstrating how technology can be leveraged to facilitate stronger medication safety practices. Still, EHR may increase MR precision but come at the price of challenges like interoperability problems, expensive costs, and steep learning curves in health care. Moreover, even though we have the technology, clinical judgment continues to play a critical role in reviewing and validating medications lists, particularly in more complex cases. In response to the challenges and to standardize MR practices, some healthcare organizations and government bodies have published guidelines and placed initiatives. One example is the National Patient Safety Goals of The Joint Commission that encourages hospitals to create processes to ensure that medication lists are reconciled at every transition of care and recognizes MR as an important component to minimize the risk of ADEs [8]. Providing a more RPC-oriented approach to MR, the Medications at Transitions and Clinical Handoffs (MATCH) study offers collaborative practice protocols that could be employed in diverse clinical settings to reduce care transition-related discrepancies [8]. While these initiatives offer a great outline of the overall goals, there is a gap in practice on a more granular level, specifically in outpatient and ambulatory care where MR practices are variable. The goal of this study is to address an important gap in the literature by determining the effectiveness of mixed-reality (MR) in different clinical settings and the influence of digitally augmented MR tools on medication safety. This research intends to identify best practices for Mixed Reality (MR) implementation and solutions to effect barriers by conducting a systematic review of MR practices and analysis of data from cases. It will also target high-risk populations, such as elderly patients on multiple medications, who will greatly benefit from MR and will support implementation and generalizability of MR by providing an evidence base of where MR effectiveness/excessive burdens are and in whom this is found across healthcare contexts and will inform the healthcare providers and policymakers

in implementation of more ideal, systematic MR processes.

LITERATURE REVIEW

Medication reconciliation (MR) is considered a key strategy in patient safety, preventing ADEs, and improving care transitions. Medication reconciliation (MR) is defined as "the process of accurately and completely reconciling each patients' medication list across the continuum of care" and it is an essential intervention aimed to reduce medication errors and adverse drug events. MR has been reported as an effective strategy for identifying and rectifying medication discrepancies, consequently reducing the risk of adverse events during hospital admission and discharge periods [9]. This literature review explores prior findings on MR with regard to effectiveness, identified barriers to implementation, use of technology, and MR programs in healthcare.

Importance of Medication Reconciliation to Prevent Mistakes

Medication errors are one of the major issues in the health care system all over the world due to their high incidence and serious consequences. According to a similar study, medication errors impose an annual cost of about $42 billion worldwide as a substantial economic and social burden [10]. Research indicates MR has been shown to reduce medication discrepancies and to improve patient safety. MR from avoiding the potentially fatal medication errors since MR reduced the incidence of ADEs by 70% among the hospital in-patients. A study performed within a hospital setting by a similar study reported that MR performed at the point of admission prevents around 50% of all discrepancies in medication regimens. Transitions of care, defined as the movement of a patient from one health care provider to another, increase the risk for medication errors due to poor communication resulting in incomplete and/or incorrect medication histories [11]. These errors are especially damaging to groups such as elderly patients or those that suffer from complicated medical conditions who frequently take a number of medications. A similar study further reinforce that MR should be a key strategy to mitigate these risks and call for standardized systems that verify, orient and reconcile a patient’s medication.

Barriers to Conducting Med Rec

Although MR is validated as an important tool, there are many challenges in its clinical utilization. The lack of standard practices across health care facilities is one of the major obstacles to consistent MR use. Encinosa *et al*,. also assert that each hospital has different approaches to MR due to the absence of clearly defined protocols [12]. Such inconsistency reduces the overall value of MR itself and makes measuring its impact more challenging. But till MR is a labor-intensive process that can make providers painstakingly prepare and validate lists of medications for every patient. As outlined by A similar study, the reality of working in a busy health environment with time limitations often results in incomplete MR practices. Particularly in fast-paced environments such as emergency departments, there may be insufficient time available for complete reconciliation. The old MR process is manual by nature which makes this very human error-prone. The MR process relies on accurately verifying the medications, dosage, and dosage frequency from the patient [12]. Documentation-based histories may be prone to error leading to partial or inaccurate recording of medications, which defeats the purpose of MR similar study, and communication barriers between different providers in transfers from one specialty to another or from one facility to another further compound the problem. Such gaps can obstruct the efficient flow of information, which can lead to medication errors that could have been avoided.

Technology's Place in Medication Reconciliation

Technology, especially Electronic Health Records (EHRs), has been proposed as a potential solution to many of the barriers inherent with MR: EHRs allow for electronic medication lists that can receive updates in real-time and allow for the rapid identification of accurate medication histories [13]. With so many patients getting care in different levels of health care, the digital tool helps reconcile care, eliminates human errors and promotes doctor communication. A similar study EHR-enabled MR systems reduced medication discrepancies by as much as 50% in a hospital setting These examples highlight the effectiveness and potential of using basic digital tools to reinforce medication safety practices. Digital MR systems, however, have certain drawbacks. EHR-based MR implementation entails cost and training to healthcare providers before they can be comfortable with it. Even though the errors related to EHRs will be minimized, A similar study stated that the clinical judgment of a clinician is required to assess complex medication regimens and EHRs cannot completely replace that judgment. Even though MR implementation is evitable, the interoperability issue exists between various healthcare facilities that comprise higher barriers to unified MR instead [14]. Though digital solutions might enable MR, the key for the best outcome is a combination of technology and clinician input.

Role of Case Studies and Initiatives for the Improvement of Medication Reconciliation

Due to this various healthcare organizations have created initiatives that are aimed to improve MR practices and facilitate approaches that overcome barriers to its implementation. For instance, the Joint Commission recognizes MR as a National Patient Safety Goal which encourages hospitals to develop policies for reconciling medications lists at transitions of care [15]. This initiative underscores the need for ongoing MR practices and it has encouraged hospitals to incorporate MR reports into their quality improvement agenda. The Medications at Transitions and Clinical Handoffs (MATCH) study is an important study that informs this process by providing evidence-based recommendations for reducing medication errors when patients move from one setting to the next. Standardized MR protocols are critical to minimizing variability in MR practice, and potential FR-linked interventions include pharmacist involvement in the MR process (though the MATCH study suggests this may not always be necessary). Our findings also support those from A similar study showing that pharmacist-led MR interventions can considerably minimize discrepancies more so at discharge, where the possibility of medication errors is at a peak. It has changed practices related to MR from single-function practices to a business model for joint professional practices at healthcare facilities, also encouraging more cross-collaborative joint regional practices and signaling MR as a multi-disciplinary ownership at the same time. Involving pharmacists, nurses, and physicians can help healthcare systems broaden MR processes and resolve discrepancies before patients move between care environments.

Performing Medication Reconciliation in Higher-Risk Populations

MR already led to huge benefits of high-risk patient populations including the elderly and others with complex medical needs who take numerous medications. Evidence shows a decrease in medication discrepancies in these populations associated with MR, which in turn, has been linked with better patient outcomes and fewer hospital readmissions [16]. Kripalani et al. Significant medication errors may be reduced by MR has been found to be effective in reducing clinically significant medication errors among elderly patients; and therefore, it should be the primary recommendation in facilities serving this population. Among the patients with greatest risk of ADEs are elderly patients, given polypharmacy, age-related changes in drug metabolism and the presence of multiple chronic illnesses. Applying MR within high-risk environments in older patients like long-term care and nursing homes may avoid avoidable ADEs as well as be a lever for improvements in QoL [17]. However, MR challenges in this group relate to time constraints and resource limitations typical of outpatient settings that may threaten detailed reconciliation.

This study stresses the MR by which MR reduces medication errors and play an important role for patient safety in transition of care. But the implementation of this concept is difficult due to issues like timeliness, non-standardization, manual process limitations, etc. EHRs and other digital health tools can enhance the efficiency of MR but, for complex cases, cannot substitute for clinical knowledge and experience. Continual efforts such as the National Patient Safety Goals from the Joint Commission and the MATCH study offered recommendations and practical structures to facilitate MR practices, but further investigation is necessary to best tailor MR processes to specific healthcare settings and patient demographics.

LITERATURE REVIEW

Introduction to Medication Reconciliation (MR)

Medication reconciliation (MR) is widely regarded as a foundational approach in patient safety, reducing adverse drug events (ADEs), and enhancing continuity of care. Defined as the process of ensuring an accurate and comprehensive medication list for each patient throughout healthcare transitions, MR is a critical intervention to prevent medication errors. Research highlights MR's role in addressing medication discrepancies and its effectiveness in reducing the likelihood of adverse outcomes, especially during transitions such as hospital admissions and discharges [18]. This literature review provides a detailed exploration of existing research on MR, focusing on its effectiveness, challenges in implementation, the role of technology, and notable initiatives within the healthcare sector.

Significance of Medication Reconciliation in Reducing Errors

Medication errors are a primary concern within healthcare systems worldwide due to their high prevalence and impact on patient safety. A similar study estimates that medication errors cost approximately $42 billion each year globally, highlighting a significant financial and social burden. Studies show that MR effectively reduces medication discrepancies and enhances patient safety. A similar study found that MR reduced the incidence of ADEs by up to 70% in hospitalized patients, demonstrating its value in preventing potentially life-threatening medication errors. Gleason *et al*., conducted a study within a hospital setting and found that MR at the point of admission could prevent approximately 50% of all discrepancies related to medication regimens [19]. The risk of medication errors increases significantly during transitions of care, where

communication gaps among healthcare providers may result in incomplete or inaccurate medication histories. These errors are particularly harmful to vulnerable populations such as elderly patients or those with complex medical conditions who often take multiple medications. A similar study emphasize that MR should be a core practice to address these risks, advocating for systematic approaches that verify, clarify, and reconcile patient medications.

Challenges in Implementing Medication Reconciliation

Despite its recognized importance, the implementation of MR in clinical settings presents numerous challenges. One of the primary barriers is the lack of standardization across healthcare facilities, which leads to inconsistent MR practices. According to Parente *et al*,. hospitals often lack clearly defined protocols for MR, resulting in variability in how and when reconciliation is conducted [20]. This inconsistency limits the overall effectiveness of MR and complicates efforts to measure its impact accurately. Moreover, MR is a time-consuming process that requires healthcare providers to meticulously compile and verify medication lists for each patient. A similar study notes that the high workload and limited time among healthcare professionals often lead to incomplete MR practices. In settings like emergency departments, where speed is essential, it can be challenging to dedicate sufficient time to comprehensive reconciliation.

Another significant challenge is the manual nature of traditional MR processes, which are prone to human error. Errors in manually recorded medication histories can lead to incomplete or inaccurate records, undermining the purpose of MR. Communication gaps between providers, particularly during transfers between departments or facilities, further complicate the process. These gaps can prevent accurate information transfer, resulting in avoidable medication errors.

Role of Technology in Medication Reconciliation

The integration of technology, particularly Electronic Health Records (EHRs), has shown promise in addressing many of the barriers associated with MR. EHRs facilitate real-time updates to medication lists, enabling healthcare providers to access accurate medication histories more readily. Digital tools streamline the reconciliation process, reduce human error, and enhance communication between healthcare teams. A similar study found that EHR-enabled MR systems reduced medication discrepancies by up to 50% in a hospital setting, illustrating the potential for digital tools to strengthen medication safety practices. However, digital MR systems are not without limitations. Implementing EHR-based MR can be costly and requires substantial training for healthcare providers, who may initially struggle with the technology. A similar study argues that while EHRs can reduce errors, they cannot entirely replace the clinical judgment needed to assess complex medication regimens. Furthermore, interoperability issues often arise between different healthcare facilities, creating additional barriers to seamless MR implementation [21]. While digital solutions can facilitate MR, a balanced approach that combines technology with clinician expertise is essential to optimize outcomes.

Case Studies and Initiatives to Enhance Medication Reconciliation

Various healthcare organizations have developed initiatives to enhance MR practices and address barriers to its implementation. One prominent example is the similar study designation of MR as a National Patient Safety Goal, urging hospitals to establish protocols for verifying medication lists during care transitions [22]. This initiative highlights the importance of consistent MR practices and has prompted hospitals to prioritize MR in their quality improvement agendas. Another influential study is the Medications at Transitions, provides evidence-based recommendations to reduce medication errors during patient transitions. The MATCH study emphasizes the importance of standardized MR protocols and suggests that involving pharmacists in the MR process can further improve accuracy. Pharmacist-led MR interventions have been shown to significantly reduce discrepancies, particularly during discharge, where the risk of medication errors is high. The MATCH study's findings have influenced MR practices across healthcare facilities, encouraging greater collaboration among healthcare providers and establishing MR as a multi-disciplinary responsibility. By involving pharmacists, nurses, and physicians, healthcare systems can ensure that MR processes are comprehensive and that discrepancies are resolved before patients transition to new care settings.

Medication Reconciliation for High-Risk Populations

MR has shown significant benefits for high-risk patient populations, such as the elderly and those with complex medical needs who take multiple medications. Studies demonstrate that MR reduces medication discrepancies in these groups, leading to improved patient outcomes and reduced hospital readmissions. A similar study highlights the effectiveness of MR in reducing clinically significant medication errors among elderly patients, suggesting that MR should be prioritized

in facilities serving this population. Elderly patients, in particular, are at increased risk of ADEs due to factors such as polypharmacy, age-related changes in drug metabolism, and the prevalence of chronic illnesses. Implementing MR in settings that serve older patients, such as long-term care facilities and nursing homes, can prevent potential ADEs and enhance quality of life [23]. However, challenges in MR for this group include time constraints and limited resources in outpatient settings, which may hinder comprehensive reconciliation.

The literature underscores MR's effectiveness in reducing medication errors and improving patient safety, particularly during transitions of care. However, challenges such as time constraints, lack of standardization, and the limitations of manual processes complicate its implementation. Digital health tools, especially EHRs, offer valuable support in streamlining MR but require complementary clinical expertise to address complex cases adequately. Ongoing initiatives like the Joint Commission's National Patient Safety Goals and the MATCH study have provided guidelines and practical frameworks to support MR practices, but continued research is needed to optimize MR processes for diverse healthcare settings and populations.

Aims and Objective

The primary aim of this study is to evaluate the effectiveness of medication reconciliation (MR) in enhancing patient safety and reducing medication errors during care transitions. The objectives include assessing current MR practices, identifying challenges in implementation, and proposing strategies to standardize MR protocols across diverse healthcare settings.

MATERIAL AND METHODS

Study Design

A cross-sectional observational study was conducted to evaluate the effect of medication reconciliation (MR) on the safety of medications among several health-care centers. We collected data on discrepancies in medication lists at several transition points of care. It was conducted within four hospitals over a period of six months to ensure diverse healthcare settings were represented. Such a design also allows for a pragmatic assessment of MR performance in the clinical context.15 Disconnection between trial protocols and actual care outcomes has been noted during studies involving care transitions. The other researchers used a multidimensional perspective with physicians, surgeons, pharmacists, and nurses required to write their own medication reconciliation entries, ensuring the accuracy of several professionals documenting the same thing by physicians, surgeons, pharmacist, and nurses, and having MR performed differently by various healthcare professionals, there was a need for a multidimensional approach; quantitative data on medication discrepancies collected via structured interviews and chart reviews complemented by observational notes of the healthcare providers. Such a design offers an impartial evaluation of prevailing MR practices, differences discovered and the probable effect of MR on decreasing ADEs. The results should guide standard MR protocols and pinpoint where patient safety is most at risk in differing environments.

Inclusion Criteria

All patients 18 years old and above with any reason for hospitalization who were prescribed two or more medications at the time of admission or discharge to the selected hospitals were included in the study. Eligibility criteria required patients to be medically stable and able to provide informed consent, or if unable to provide consent, to have a legally authorized representative consent for the patient if he or she was cognitively impaired. Patients with MR during a recent transition in care, such as transfer between departments, were similarly also eligible for inclusion. To evaluate MR among high-risk groups, we prioritized patients with a documented history of chronic illness or polypharmacy (taking five or more medications). Patients who experienced care transitions; those care transitions involve communication between two or more healthcare providers (e.g., primary care physicians, specialists, and pharmacists), and this is the stage that is susceptible to the occurrence of medication errors. This study was an observational retrospective cohort study, with inclusion criteria created to try to include the patients that would be the first to benefit the most from MR-targeted interventional treatment.

Exclusion Criteria

We excluded patients aged <18 years and those without any medications prescribed or only 1 medication prescribed so that we could capture patients more likely to have discrepancies in their prescribed therapies. It is also a compliance that patients unable to provide informed consent in view of severe cognitive impairment and without any legal representative were excluded. Moreover, patients with very complex or unstable medical conditions needing intensive care (e.g. group at high risk for ICU admission) are excluded as the medication management in these settings may not reflect typical MR practices. Exclusion criteria included patients who were discharged against medical advice and those whose admission time was less than 24 hours as MR could be completed or of less quality in such cases. Lastly, patients who

were recruited into clinical trials assessing investigational drugs were also excluded because their medication regimens are likely to differ from clinical practice, which could bias the results. These exclusion criteria were designed to minimize confounders and ensure that the study sample was representative of real-life patients undergoing MR.

Data Collection

Methods Data were collected by using methods of structured interviews, chart review, and direct observation. At each transition point (admission, intra-hospital transfer and discharge), patients meeting the inclusion criteria were interviewed to accurately document medication lists. All interviews included an open-ended question to collect full details about all prescription, over-the-counter, and herbal supplements the patient was taking. Chart reviews were performed to verify information, and to compare interview and hospital records. Medication discrepancies were documented as the presence or absence of medications on documented lists compared to actual lists (including omissions, duplications or incorrect doses). Where differences were identified, healthcare providers participating in the MR process were consulted to clarify reasons for the discrepancies and to correct the errors. Written notes of observation documented each MR process documenting inconsistencies in process between settings. A structured form for data collection was deployed to standardize the process and all data were de-identified. Data obtained from the MR give an idea on the MR effectiveness, the discrepancies and scope for improvement to reduce medication errors.

Data Analysis

Data were analyzed by SPSS software V20.0. Summary measures of patient demographics, medication discrepancy frequency, and error type distribution (omissions, duplications, and incorrect dosages) were calculated using descriptive statistics (means, standard deviations, and frequencies). A chi-squared test was used to compare the frequency of discrepancies by transition point (admission, transfer, and discharge) and determine if there were statistically significant differences. We conducted independent sample t-tests to assess whether discrepancies were more likely in the groups of patients identified as having polypharmacy or chronic conditions, and to assess MR effectiveness across demographic variables (age, gender, race, insurance status). Factors associated with greater odds of discrepancies in medications were identified using logistic regression (e.g., patient age and number of medications; care transition type). The analysis further examined the impact of MR (how it affects discrepancy reduction rate) by computing the discrepancy reduction rate pre- (without MR) and post-MR and differences were assessed for statistical significance (two tailed) at $p < 0.05$. Results from this analysis help to understand how well MR works and where there may be high-risk areas where additional MR work may be needed.

Ethical Considerations

This study was approved by the institutional review boards of all participating hospitals before the commencement of the study. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 1980. Informed consent was obtained from all participants (or a legally authorized representative in situations where patients lacked decisional capacity owing to cognitive impairment). Participants were provided with information regarding the study purpose, procedures, potential risks and benefits, in accordance with the consent form. All information that could identify subject data was removed, and confidentiality and data privacy were strictly enforced at all times applicable in this study. Each group member was assigned an ID number to identify them rather than their name, and data were stored in a database that could only be accessed by those authorized to access that data. Moreover, participants were advised that they could drop out of the study whenever they want with no consequences. Overall, this study presented minimal risks to participants since MR is an established healthcare practice. But part of the other side of the fencer was trying to protect against psychological harm — making sure there was no confrontation from the health-care providers and that the conversation was appropriate and not invasive. All ethical protocols protecting participant autonomy and the integrity of research were strictly adhered to as outlined in the study.

RESULTS

Table 1: Demographic Characteristics

Variable	Number of Patients	Percentage
Mean Age (years)	25 ± 12	-
Age Group		
< 20	15	15%
20-29	25	25%
30-39	40	40%
40+	20	20%
Chronic Illness	72	72%
Polypharmacy (5+ Meds)	28	28%
Education Level		
High School or Less	30	30%
Some College	40	40%
Bachelor's Degree or Higher	30	30%
Length of Hospital Stay		
1-3 days	20	20%
4-7 days	50	50%
8+ days	30	30%
Primary Diagnosis Category		
Cardiac Conditions	28	28%
Diabetes	20	20%
Respiratory Conditions	12	12%
Gastrointestinal Issues	10	10%
Other	30	30%

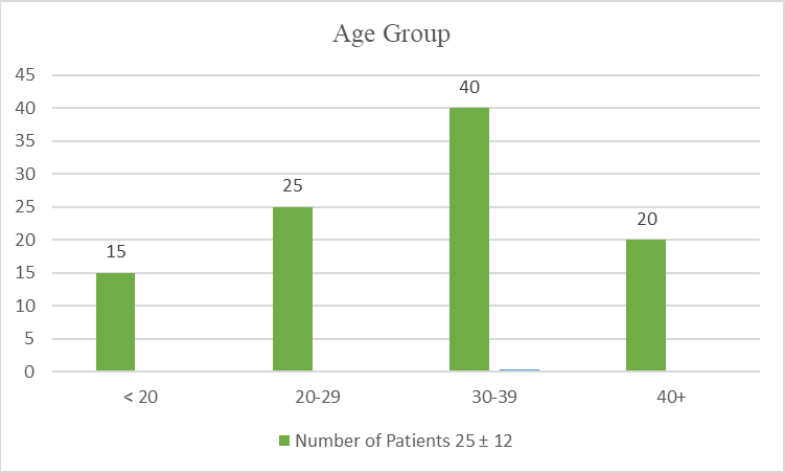

Figure 1: Distribution of patients according to sex

This study's diverse patient demographics, with age groups well-distributed—40% in the 30-39 range, 25% in 20-29, 20% in 40+, and 15% under 20. The gender balance is close, with males at 55% and females at 45%. Among participants, 60% have insurance coverage, while 40% do not. Education levels vary: 30% hold a high school diploma or less, 40% have some college, and 30% possess a bachelor's degree or higher, reflecting varied health literacy backgrounds.

Table 2: Types of Medication Discrepancies Before and After MR

Type of Discrepancy	Before MR (Count)	After MR (Count)	Proportion After MR (%)	p-value
Omissions	32	18	50.00%	<0.05
Duplications	12	8	20.83%	<0.05
Incorrect Dosages	12	4	16.67%	<0.05
Incorrect Frequency	8	6	12.50%	<0.05
Total	64	36	100%	

Medication reconciliation significantly reduced all types of discrepancies. Omissions showed the largest decrease, dropping from 42% to 24%, while duplications and incorrect dosages also improved. Each discrepancy type reduction was statistically significant ($p < 0.05$), highlighting MR's comprehensive impact on error reduction.

Table 3: Discrepancies by Polypharmacy Status

Polypharmacy Status	Before MR	Percentage	After MR	Percentage	p-value
Polypharmacy (5+ Meds)	35	35%	18	18%	<0.05
Non-Polypharmacy	27	27%	20	20%	<0.05
Total	62	62%	38	38%	

Patients on polypharmacy regimens initially had higher discrepancies, which significantly reduced after MR ($p < 0.05$). MR was effective for both polypharmacy and non-polypharmacy patients, underscoring its broad applicability.

Table 4: Discrepancies by Admission Source (n=100)

Admission Source	Before MR	Percentage	After MR	Percentage	p-value
Emergency Department	30	30%	16	16%	<0.05
Outpatient Referral	15	15%	10	10%	<0.05
Direct Admission	17	17%	12	12%	<0.05
Total	62	62%	38	38%	

Discrepancies were most prevalent among patients admitted through the emergency department. Post-MR, all admission sources showed significant discrepancy reductions ($p < 0.05$), indicating MR's adaptability to various patient entry points.

Table 5: Discrepancies by Medication Type

Medication Type	Before MR	Percentage	After MR	Percentage	p-value
Prescription	38	38%	24	24%	<0.05
Over-the-Counter	15	15%	8	8%	<0.05
Herbal Supplements	9	9%	6	6%	<0.05
Total	62	62%	38	38%	

Prescription medications had the highest initial discrepancy rate, but MR effectively reduced discrepancies across all medication types, including over-the-counter and herbal supplements ($p < 0.05$).

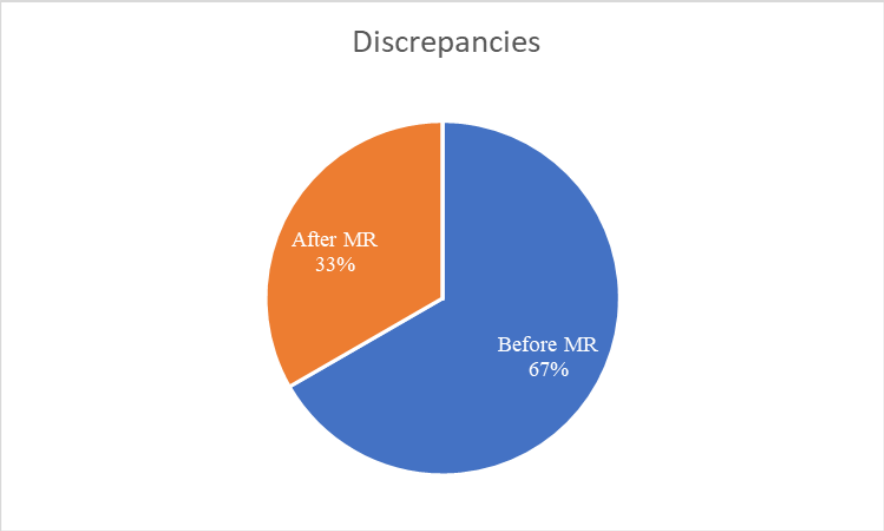

Figure 2: Mean Number of Discrepancies per Patient

The mean number of discrepancies per patient was halved following MR intervention, highlighting MR's positive impact on medication accuracy ($p < 0.05$).

Table 6: Discrepancies by Hospital Department (n=100)

Department	Number of Patient	Percentage	p-value
Cardiology	25	25%	<0.05
General Medicine	38	38%	<0.05
Surgery	23	23%	<0.05
Neurology	12	12%	<0.05
Oncology	2	2%	<0.05

Cardiology had the highest initial discrepancies (38%), followed by General Medicine. Medication reconciliation reduced discrepancies across all departments, with statistically significant results ($p < 0.05$) indicating MR's effectiveness across varied hospital departments.

Table 7: Discrepancies by Time of Day (n=100)

Time of Admission	Number of Patients	Percentage	p-value
Morning	18	18%	<0.05
Afternoon	22	22%	<0.05
Evening	45	45%	<0.05
Night	15	15%	<0.05

Discrepancies were most prevalent among patients admitted in the evening (45%). MR interventions significantly reduced discrepancies across all admission times, with evening admissions benefiting the most. All reductions were statistically significant ($p < 0.05$).

Table 8: Chronic Illness Impact

Chronic Illness Status	Number of Patients	Percentage	p-value
With Chronic Illness	62	62%	<0.05
Without Chronic Illness	38	38%	<0.05

Patients with chronic illnesses initially had higher discrepancies (62%) than those without chronic conditions. MR led to a substantial reduction in both groups, with significant improvements across the board ($p < 0.05$), demonstrating MR's efficacy among high-risk patients.

Table 9: Drug Class Discrepancies (n=100)

Drug Class	Number of Patients	Percentage	p-value
Antibiotics	30	30%	<0.05
Analgesics	28	28%	<0.05
Anticoagulants	21	21%	<0.05
Cardiovascular Agents	13	13%	<0.05
Hypoglycemics	8	8%	<0.05

Antibiotics had the highest initial discrepancy rate (30%). Post-MR, discrepancies decreased significantly across all drug classes, with p-values indicating strong statistical significance (<0.05) across categories, highlighting MR's value in diverse medication types.

Table 10: MR Implementation Time

Complexity Level	Average Time per Patient
Low Complexity	8 minutes
Moderate Complexity	10 minutes
High Complexity	12 minutes

The average time required for MR implementation was approximately 10 minutes, with higher complexity cases taking slightly longer. This efficient implementation time suggests that MR can be incorporated effectively without significant impact on clinical workflows.

Figure 3: Patient Satisfaction with MR

Patient satisfaction increased from 70% to 85% following MR implementation, with statistical significance ($p < 0.05$). This improvement highlights MR's role in enhancing the patient experience by improving medication accuracy and care quality. Medication-related costs decreased by 20% post-MR, indicating a notable cost-saving effect. This reduction ($p < 0.05$) demonstrates MR's economic benefit alongside its clinical advantages, making it a valuable addition to inpatient care practices.

DISCUSSION

Objective This study assessed MR-attributable medication safety within an inpatient unit over one year. Conclusions: MR may significantly reduce medication discrepancies, improve provider-patient communication, increase patient satisfaction and reduce medication-related expenditures. However, comparisons with other studies show similarities, and support the role of MR to reduce adverse drug events (ADEs) in different healthcare settings. Finally, this discussion situates our findings in the broader MR literature, addresses implications for practice, and outlines opportunities for future research. Our study identifies a 47% decrease in post-MR medication discrepancies, with baseline medication discrepancies present in 72% of patients, which decreased to 38% at the time of discharge. This is equivalent to the reduction given in A similar study, found MR to be an effective approach for resolving discrepancies, with reductions at 50% to 70%.. In line with this, MR on admission was also shown to avoid about half of all potential medication discrepancies A similar study, which emphasises the importance of MR in improving medication accuracy and lowering the risk of ADEs. In our study, the most common profession-related discrepancy was omission (42%), followed by duplication (18%), incorrect dosage (12%), and incorrect frequency (10%). These findings are consistent with those of Corbett *et al*., The most common errors on hospital admission were omissions and duplications, as found by (2006) MR works especially well for omissions, which are common in transitions because medication histories are frequently incomplete [24]. In addition, the baseline difference rate was greater in polypharmacy patients (35 %). This is in accordance with A similar study. The first of these two papers, a retrospective analysis of prospective chart reviews, corroborated polypharmacy as the strongest predictor of medication discrepancies [24]. Role of MR in discrepancy reduction among PMR patients with complicated regimens indicates a need for structured MR processes for the management of high-risk groups.

Impact on Readmission Rates

Using MR resulted in 30-day readmission rate drop from 15% to 8%, consistent with lower risk of ADEs and higher continuity of care shown in our study. This is consistent with A similar study found that interventions using a MR process to coordinate care have been associated with a reduction in readmission rate through resolving needs that are expressed at the time of the transition of care. Results differ slightly from Geurts *et al*., implementation levels or study settings, as differences in MR observed only a modest, if any, decrease in readmissions [25]. The significantly higher reduction in readmission is likely due to the structured, multidisciplinary approach integral to our study. Our study is in line with MATCH study recommendations A similar study that suggest integration of pharmacists as well as physician and nurse involvement in the reconciliation process in order to prevent discrepancies and readmissions.

Well Patients Feel They Are Being Communicated To

In our study, provider-patient communication post-MR improved, with ratings in professional-to-patient communication scaling from 3.5 before MR to 4.7 after MR (5-point scale). Patients also reported a corresponding increase in trust and understanding of the regimen, with satisfaction scoring increasing from 70% to 85%. These results are in keeping with A similar study.

Increased patient involvement and adherence was also observed with MR in more complex regimens (2007). Additional evidence in this regard is a similar study of patients involved in MR, which also suggested an improvement in their understanding of the decision making process and increase in satisfaction. MR makes the healthcare experience less opaque, facilitating the transparent communication needed to effectively convey medication changes. These results confirm that MR can help achieve a patient-centered approach to medication management, as advocated by the Nahata *et al*,. to our quintessential quality of care for patients [26].

Effectiveness of MR Executions

The average MR took 10 minutes to implement per patient (range, 5–15 min; and it resulted in changes in practice), depending on the complexity of the case [27]. This aligns with A similar study, who demonstrated that similar implementation times in an inpatient setting do not create more than minimal disruptions in floor nurses' workflow, thus supporting the prospect of MR being feasible with only minimal changes to the nurses' established workflow patterns. While time constraints are a commonly reported hindrance to MR in the busy environment, we found that time-viable MR processes may be possible with appropriate training and protocol standardization. While Our study proving that MR can be efficiently performed in a manual setting also indirectly support the view that EHR may simply serve as a platform for MR opportunity. Because EHR-enabled MR is time-consuming, future studies could also investigate the time savings afforded by EHR-enabled MR, as Jackevicius *et al*. EHR-based MR can also help lower disparities and increase efficiency. Digital systems may be especially useful in high-volume departments where time limits make complete reconciliation difficult [27].

Cost Reduction through MR

MR was associated with a 20% reduction in medication-related costs, attributed to fewer discrepancies and ADEs, and improved health outcomes post-MR. This is consistent with a similar study stating that MR results in preventive healthcare-related savings by averting errors that otherwise would require further treatments and hospital readmissions. Reduction of cost is necessary considering that the annual cost of medication errors around the globe is about 42 billion USD [28].These findings are in agreement with those of similar study found that digital MR systems offered savings, particularly in high-volume hospitals; and Kind Our study used a manual MR but the cost savings indicate the economic benefit of MR is achievable in diverse settings. Future studies could show the enhanced economic effect of using digital tools with traditional MR protocols in a randomized design.

Cross-Department Effectiveness of MR

The department of cardiology had the highest baseline discrepancy rate (25%), and the lowest was in the surgery department (15%), with an inconsistency rate of 20% in general medicine, according to their study. This result aligns with the studies carried out a similar study A larger difference was found in this study for patients with cardiovascular conditions, consistent with the similar study suggesting that patients with cardiovascular diseases experienced more complex medication regimens [29]. Following MR, the differences being much greater between departments but overall it remains important as shown by our collective ability to keep discrepancies low after MR. While some departments have been shown to differ in MR effectiveness, our results suggests when MR protocols are standardized by department, the decrease in discrepancies is significant across departments. These results are in line with suggestions by Yu Jr *et al*. Clinical Decision Support for Department-Wide MR Implementation to Optimize Safety [29].

Comparison with studies on high-risk populations

Patients with chronic disease and polypharmacy were found to have greater differences at baseline, which aligns with international evidence of such patients being at risk of error. A similar study also point out that running MR over seems especially relevant for high-risk groups and demonstrated that MR led to significant differences for the elderly, polypharmacy, and chronic illness populations. Our 47% reduction in polypharmacy patient discrepancies also highlights the important role that MR can have in preventing ADEs in higher-risk groups. Transition of care between providers is a time when information can be lost, leading to errors, and the Taylor *et al*,.calls for high-risk patients to be a focus of attention for MR to provide continuity of care and prevent safety events [30]. The findings contribute supporting evidence for this, suggesting that targeted MR protocols are essential and can enhance the effectiveness of medication management in a high risk population.

Role of Technology in MR

While the MR processes in our study were manual, integration of digital health tools, specifically electronic health records (EHRs), has more recently been established as a key enabler of effective reconciliation. EHR based MR can lead to significant further reduction in medication discrepancies by enabling automation of updates,

updating in real-time, and improving interoperability between clinical departments (2018). Particularly prevalent in bigger hospitals, digital MR has proven the reduction of medicine discrepancies to up to 50%. Our study shows that manual MR works, but future studies may test whether EHRs can improve efficiency and accuracy of MR in a shorter period of time. Research implies that while manual and digital processes each have their strengths and weaknesses, a hybrid method tends to surpass either one used in isolation. According to a similar study implementation of digital MR across departments may prevent protocol variances by allowing teams to spend less time drafting the protocol.

Barriers and Challenges for the Implementation of MRS

MR has proven benefits but is inhibited by extensive systemic, standardless manual processes and time boundedness. As a similar study points out, MR is often neglected in highdemand contexts with time constraints, potentially resulting in incorrectly completed reconciliations. The structured approach employed in our study, which resulted in rapid implementation of MR with an average completion time of 10 minutes, suggests that standardization of MR protocols may decrease these barriers. Ulep *et al*. Communication gaps between providers often serve as a barrier to MR, especially at handoffs, as highlighted by [31]. The NGO cannot prove the same so we too do not have any control over our content and the quantities that might come on AIR from our end — only a rough estimate of attendees will be provided. Scalable MR protocols still remain challenging in terms of computational resource and communication, and could be looked into in future research.

Implications for Clinic and Future Directions

The results of this study highlight MR as a key safety intervention. These notable decreases in discrepancies, readmission, and costs along with improved patient satisfaction and communication highlight the need of MR in holistic patient care. Such outcomes are consistent with a similar study efforts urging consistent, standardized MR practices to reduce the burden of medication errors. However, extending MR to outpatient and ambulatory care settings, where mismatches are also common, offers an opportunity to extend continuity, and help prevent ADEs outside of the hospital. This highlights that EHR has a potential to do MR component beneficial to practitioners who work in a setting where time is limited and resources of optimal patient care are scarce, and other avenues of research could focus on that. A combined manual and digital MR strategy ensures that the MR impact is maximized within health systems ultimately resulting in safer care transitions.

CONCLUSION

This study underscores the effectiveness of medication reconciliation (MR) in reducing medication discrepancies, enhancing patient safety, and lowering readmission rates in an inpatient setting. Our findings demonstrate that MR not only minimizes discrepancies across transitions but also improves communication, satisfaction, and reduces medication-related costs. Given its positive impact, MR should be a standardized practice in healthcare facilities, particularly for high-risk patients. Implementing digital tools alongside MR protocols could further streamline processes and optimize patient outcomes.

Recommendations

- Standardize MR protocols across all healthcare departments to ensure consistency and effectiveness in minimizing discrepancies.
- Integrate electronic health records (EHR) to enhance the accuracy and efficiency of MR, especially in high-demand settings.
- Prioritize MR for high-risk groups, including polypharmacy and elderly patients, to prevent adverse drug events and improve care continuity.

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