

A CRITICAL APPRAISAL OF CURRENT PRACTICES, IMPLEMENTATION STRATEGIES, AND CLINICAL OUTCOMES

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ABSTRACT

Medication reconciliation [MR] is an essential safety process where a patient's active medication list is compared with that prescribed newly with each care transition MR serves as an important safety tool to ensure accurate and up-to-date medication records thereby minimizing medication errors adverse drug events and unnecessary duplication during care transitions Despite its importance MR has not yet been implemented systematically and consistently throughout all areas of health care and consequently avoidable patient harm has occurred which in turn leads to high costs. This review synthesizes the current state of practice around MR, challenges encountered with its implementation, facilitators that enhance adoption, and clinical outcome results. We undertook an exhaustive review of all available peer-reviewed published reports for medication reconciliation intervention, IT-supported intervention, and multidisciplinary approaches.

The result suggests that systematically reconciled medication lists aided by hospital health care information systems and teamwork of multidisciplinary team result in significantly lower number of medication discrepancies and adverse events.

Nevertheless, several challenges of resources and operational constraints such as inefficient clinical workflow and limited physician compliance make it difficult to reconcile medication in all the scenarios. The article proposes standardization of medication reconciliation in form of evidence-based procedures as well as utilizing innovation technology and committing organization is imperative for improving patient safety and medical outcomes.

KEYWORDS: medication reconciliation, medication errors, patient safety, care transitions, adverse drug events, medication discrepancies.

1. INTRODUCTION

Medication management has been highlighted as a critical component of patient care and safety throughout healthcare delivery across the globe. As reported by the Institute of Medicine, medication errors rank among the leading preventable medical errors occurring in the United States annually, with up to 1.5 million injuries attributed to these events [1]. Medication discrepancies between a patient's present medication orders and current prescribed medication, particularly as the patient transitions care, contributes to a large proportion of medication errors and resultant patient harm.

Medication reconciliation is the process of generating the most complete and accurate list possible of all the medications a patient is currently taking and matching this list to the medications that have been ordered to make sure the current medications are correct and to document and manage any discrepancies between the lists [2]. This essential process should be implemented at each transition in care: on hospital admission, with transfers between clinical units or facilities, and with hospital discharge back to the community [3]. The complexity of today's healthcare systems involving a large number of caregivers and institutions and a wide variety of complicated therapies makes medication reconciliation difficult but extremely necessary [4].

There is widespread experience with unintentional medication discrepancies: between 60-70 percent of patients will have one or more unintentional medication discrepancies on hospital admission [5].

An unintentional medication discrepancy can result in a missed medication, a doubled medication, an incorrect dose or formulation, or a drug-drug interaction that can cause adverse drug events (ADEs) and subsequent hospitalizations and healthcare costs. While there is broad consensus about the importance of performing medication reconciliation, the actual performance varies greatly. Barriers to medication reconciliation include the absence of established processes, limitations of resources and personnel, system interface issues and insufficient clinician education [6]. Advanced information systems are likely to be of great help to improve medication reconciliation but they must also be appropriately and effectively implemented.

The purpose of this literature review is to consolidate current information on medication reconciliation: examine the evidence of best practices in the processes of medication reconciliation, assess the efficacy of various methods for implementation, consider the role of technology and team members, determine the challenges to successful medication reconciliation and explore factors that can promote effective medication reconciliation. Based on this information this review will provide some recommendations to facilitate further research and clinical practice improvements.

2. CURRENT EVIDENCE ON MEDICATION RECONCILIATION

2.1 Scope and Significance of Medication Discrepancies

Medication discrepancies are differences (which may be unintentional or sometimes intentional) between the medications a patient takes on their own prior to a healthcare encounter and the ones listed in the medical chart in the record of that encounter^[7]. Discrepancies of this type are quite common. In one review of 17 studies involving the detection of medication discrepancies in hospitalized patients, almost 70 percent of patients admitted to a hospital had at least one unintended discrepancy, roughly 30-40 percent of these discrepancies had a potentially serious effect^[8].

The most common types include: omission of medications that the patient took regularly prior to admission; addition of other drugs in the same class (duplicate therapies); doses or frequency changes that can lead to under- or overmedication; contraindications added to medication lists when a previously prescribed medication was not identified; or potentially harmful drug interactions that have been inadvertently introduced^[9].

Specific groups of patients are at high risk of medication discrepancies, including the elderly, patients with multiple comorbidities, and those who take five or more medicines on a daily basis. Untreated medication discrepancies may have profound negative health consequences. Evidence shows that they are linked to an increased incidence of adverse drug events, prolonged hospitalizations, higher rates of readmission, and greater health costs^[10]. One study indicated that medication discrepancies were linked to a 15-20 percent higher readmission rate within 30 days^[11], and preventable adverse drug events contribute to a vast financial cost to the health care system.

2.2 Current Medication Reconciliation Practices

Medication reconciliation strategies differ widely depending on the context; from a minimal documentation effort, to detailed multidisciplinary processes. Classical methods of medication reconciliation generally involve a physician or nurse gathering a medication history from a patient, family member, or past records at admission or upon initial patient encounter^[12]. Patients can report unreliable medication histories, as documented through the literature-reported accuracy between 50% and 70%, and often do not record medications taken on an “as needed” basis, over the counter medications or supplement use^[13].

Enhanced medication reconciliation efforts utilize a multi-source data gathering approach, which can include patient interviews, use of patient’s brought medication bottles, pharmacy dispensing data, previous records of the patient and communication with community pharmacy or other care providers^[14]. The ‘best practice’ of medication reconciliation generally encompasses a three stage process including; reconciliation upon admission (creating the accurate medication history), reconciliation during hospitalization (reconciliation as changes are made), and reconciliation upon discharge (ensuring adequate documentation, and patient care plan to prevent any necessary changes)^[15].

While the importance of the medication reconciliation has become acknowledged, numerous health care facilities have not initiated extensive program plans for their facilities. Surveys have demonstrated that fewer than 50% to 60% of hospital-based facilities have systems in place to facilitate the processes for which are expected and most community and primary health facilities lack organized medication reconciliation systems^[16]. While processes have been implemented, adherence to those processes appears to be far less than desirable as demonstrated in studies showing up to 30%-40% of eligible patients were not subjected to any form of medication reconciliation^[17].

2.3 Role of Healthcare Information Technology

The potential for EHRs and pharmacy information systems to improve medication reconciliation process is huge because they can easily retrieve the most current and complete medication data across the continuum of care^[18]. Using EHRs allows for easy identification and comparison of medications; may warn for drug interactions and create records of medication modifications^[19]. The clinical decision support functionalities incorporated into EHRs can signal the need to perform medication reconciliation on medication-related transition of care and alerts the provider of potential drug interactions or mismatches of the prescribed or dispensed medication. It has shown that use of well-designed EHR with a patient’s medication history integrated in workflow improves medication reconciliation and reducing the rate of medication errors^[20].

However, it has demonstrated that not all implemented EHR systems enhance medication reconciliation. Design, implementation and usability of EHRs, the education of clinicians to use EHRs for medication reconciliation, and their workflow integration in the day-to-day activities is necessary to maximize benefits of the EHR systems. The findings from some studies have shown EHR to hinder the reconciliation process because of bad usability and workflow fragmentation, resulting in numerous warnings, that lead to alert fatigue and finally the disregard of

warnings by the clinician, which leads to increase the errors in medication reconciliation and adverse drug events. Another reason that EHR can still be the barrier to have accurate and effective reconciliation is the poor information sharing between the different healthcare systems which care for the patients ^[21]. The problem of information fragmentation due to patients seen by multiple providers in different organizations that don't share health data system leads to complicated patient medication reconciliation.

Nevertheless, the evidence suggests that use of health information technology when well-integrated in care process contributes in the improvement of medication reconciliations and reducing the risk of ADE. Examples include pharmacy dispensing information system interoperability with prescriber information system, clinical decision support functionalities within the prescriber systems and interoperability between various care settings have been successful in optimizing the medication safety of patient in the care pathway ^[22]. Future developments of health information technology include broader adoption of prescribing system that include clinical decision support features; pharmacy information systems which can directly share their dispensing information with prescriber information systems; and sophisticated patient-facing web-portals, allowing for inclusion of patient reported medication information.

Recent evidence suggests that electronic medication reconciliation (e-MedRec) can play a vital role in improving medication safety throughout the transition of care process. Twelve different electronic medication reconciliation tools, aimed at the health professional audience, were systematically reviewed and documented in the literature in 2024. Of those tools identified, a number had evidence that supported the decrease in medication discrepancies, and subsequent risk for harm.

Several factors were associated with effective technology including interoperability of systems, easy to use design, and seamless integration with the workflow.

Digital tools should not just include the technology; it must also incorporate effective implementation methods and multidisciplinary teams to achieve successful outcomes.

2.4 Interdisciplinary Approaches to Medication Reconciliation

Medication reconciliation should be shared among all members of the healthcare team, as interdisciplinary team-based processes incorporating pharmacists, nurses, physicians, and others are more effective ^[23]. Because they have a depth of expertise regarding medications, dosing, and interactions, pharmacists are particularly adept at managing and leading comprehensive medication reconciliation activities. Research has established that programs in which pharmacists are leading or participate in the medication reconciliation process are associated with lower numbers of discrepancies and potential ADEs than are approaches solely involving physicians ^[24].

Nurses also serve as an integral component of the medication reconciliation process because of their extensive interaction time with patients and responsibility for obtaining an initial medication history ^[25].

Nursing training for appropriate comprehensive medication reconciliation techniques and the inclusion of dedicated time in nurse workloads has led to improvements in medication accuracy and patient safety. Programs that promote collaborative medication reconciliation among all healthcare team members and specify role definitions, communication patterns, and standard processes improve outcomes ^[26]. Patient participation is a final element of interdisciplinary medication reconciliation. Patient education about the value of the reconciliation process and asking patients to review medication lists and provide feedback on their medications has demonstrated a benefit for improving medication accuracy and discrepancies ^[27].

Patient-focused strategies for involvement in medication reconciliation seem to yield greater medication accuracy and more complete patient information.

2.5 Implementation Strategies and Barriers

Implementing medication reconciliation in a meaningful way involves more than just recognizing its importance. Organizational commitment, adequate resources, standardized processes, appropriate staff training, and a focus on continuous quality improvement are critical for successful medication reconciliation ^[28]. Evidence-based implementation strategies have included the use of systematic implementation techniques, such as the creation of standardized, evidence-based medication reconciliation policies and protocols, the incorporation of medication reconciliation activities into electronic workflow systems, providing staff training and education about the purpose and process of medication reconciliation to all relevant personnel, the delegation of responsibility for performing medication reconciliation activities, development and monitoring of quality indicators for medication reconciliation processes, and the establishment of a patient safety culture that promotes accurate and safe medication use ^[29].

In spite of the implementation strategies that are evidence-based, there are numerous barriers to implementation. The absence of sufficient resources-both in terms of time to perform complete medication reconciliation and, in many cases, dedicated staff or sufficient medication reconciliation capacity-is one barrier to full medication reconciliation implementation ^[30]. When medication reconciliation is not well integrated into clinical workflows, it leads to either redundancy of processes or to omission of medication reconciliation altogether when the workflow process is under time pressures or when care teams are engaged in other pressing patient activities. The lack of communication between healthcare settings, particularly given that providers of care may employ separate electronic health record systems that are not able to interoperate, remains a substantial impediment to effective reconciliation of medication lists ^[31]. The lack of reliable access to complete medication lists for those who see

care teams in multiple settings creates further complexities for reconciliation.

Resistance by staff to the implementation of medication reconciliation processes, for instance, due to concerns over increased work load or lack of understanding about the importance of medication reconciliation to patient safety, is an important challenge.

Finally, other constraints-particularly regulatory ones-impede medication reconciliation implementation, even in the face of support for medication reconciliation as an important practice by leading health care organizations and quality improvement initiatives. In most healthcare systems, explicit reimbursement for medication reconciliation services has been absent or limited, limiting institutional incentive to support the process [32].

2.6 Clinical Outcomes and Effectiveness

Numerous investigations support the efficacy of standardized medication reconciliation to minimize medication errors and adverse drug events. Medication reconciliation studies revealed that the initiation of standardized reconciliation process resulted in 37 to 75 percent of medication discrepancy errors being avoided [33]. Furthermore, patient-centered research has found evidence of the association between systematic reconciliation process with a reduction in adverse drug events and readmission rates, and improvements in clinical outcomes across multiple patient groups [34].

Studies of medication reconciliation in older adult population, where a significant rate of discrepancy errors and adverse events occurs, proved successful.

Studies showed improved patient adherence and readmission rates following thorough reconciliation at discharge along with patient and family education and coordination with their primary care physician [35]. Cost benefit analyses indicated that positive effects on reduced readmissions and averted adverse events are generally more than worth the resources expended in establishing comprehensive medication reconciliation programs [36]. Nevertheless, disparities in study protocols, outcome definition, and implementation process have led to differences in stated impact, which was weaker in certain settings where reconciliation was poorly implemented within current workflows or when staff training was inadequate.

3. FUTURE PERSPECTIVES AND RESEARCH GAPS

Despite significant progress, many avenues remain for further research and improvement in the areas of medication reconciliation. Research Gaps and Future Directions1. Interoperability and Health Information Exchange Additional research on developing and implementing interoperability and HIE standards should aim to securely share medication information among different care settings.

Future interoperability between different electronic health records (EHR), pharmacy systems, and networks of physicians should be encouraged to enhance Medication reconciliation abilities [37]. Advanced Clinical Decision Support AI- and ML- based CDS tools could identify and address many of the subtle medication discrepancies, assist clinicians in Predicting potential Medication-Related Risks, and offering a Targeted Clinical Recommendation to providers.

Further research must consider user interface designs to prevent the problem of notification exhaustion in clinical practice [38]. Patient-Centered Approaches Future Research on the most Effective ways to Engage patients, which could include patient portals, mobile health applications, and the collection of medication information from patients, can assist to increase the Accuracy of Medication Reconciliation, patient engagement and other benefits [39]. Implementation Science More vigorous Application of the techniques and concepts from implementation Science methodology in Medication Reconciliation Studies would have assist to bridge current Gaps between research and practice by guiding to effective means to translate and implement evidence-based Medication reconciliation Strategies in clinical settings, particularly in those with fewer resources and disparate organizations [40]. Vulnerable Patient Populations Studies focusing on the Medication reconciliation Needs of Pediatric Patients, pregnant Women, cognitively-impaired Patients, Patients who are receiving end-of-Life and palliative Care. Such studies are Needed to address the Existing research Gap [41]. Integrating Medication Therapy Management Further research to integrate medication reconciliation seamlessly with other medication therapy Management service is important to optimize medication Use [42]. Long Term Outcome Studies that investigate Long term Effects of the Medication Reconciliation Intervention on the Patient outcome (clinical, safety and economic) should be performed to Establish and quantify the Full Clinical and economic Benefits of Medication Reconciliation Intervention [43]. Cost Effectiveness in various settings Economic evaluations of Medication reconciliation interventions in various health settings including primary care, ambulatory specialty clinics, and low-income settings are warranted to assist with Resource allocation [44].

Digital technology linked with the electronic health record has also gained prominence recently in enhancing medication-related results. It's possible to use of a wide range of Digital tools with clinical decision support, automated medication reconciliation, and uniform documentation could reduce avoidable errors by about 20 percent and facilitate a more equitable treatment in health systems where AI and predicting will probably become an increasingly large part of reconciliation [45].

4. DISCUSSION

The evidence synthesized in this review indicates that medication reconciliation is effective if done well, but good execution remains a rarity in most settings. A wide discrepancy in the reported reduction in discrepancies across

studies, 37 to 75 percent ^[46], highlights an interpretive challenge: is this range of reported benefits the result of an inherent variation in the effect of medication reconciliation, or a result of differences in the quality of its implementation? The results discussed in Section 2.2 and Section 2.5 provide strong support for the latter hypothesis, showing better results when the practice is supported by dedicated staff time, active involvement from pharmacists and an integrated workflow with technology, rather than relying on ad-hoc approaches focused primarily on documentation.

This difference is important because it means medication reconciliation cannot be treated as a “silver bullet” with a standard effect size, but as a class of practice whose success depends on fidelity of implementation.

Another tension visible across the literature is the double role of health information technology, serving as both an enabler and a disabler of safe practices, and in particular contributing new risks when poorly executed. As is discussed in Section 2.3, poorly integrated EHR systems can contribute to alert fatigue and work fragmentation—thus undermining their own safety purposes. This implies that the important clinical and organizational question is no longer whether technology should be adopted for medication reconciliation, but how it should be designed, validated, and embedded in clinical workflows. System interoperability, usability testing by end users, and thoughtful alert design appear to be more important factors for outcome success than technology simply being “electronic,” suggesting that significant technology investment alone is unlikely to improve outcomes, and may in fact create harms, in the absence of corresponding investments in workflow redesign and clinician training.

By contrast, interdisciplinary, pharmacist-led approaches to medication reconciliation have considerably greater consistency in the evidence base, although this evidence base indicates that less than half of hospitals employ any form of structured interdisciplinary care for this purpose, and adherence to any such structures remains inconsistent ^[47].

The gap between evidence supporting this model and current practices across the United States appears to represent the principal problem illustrated in this review; that is, the problem lies not in clinical knowledge, but in implementation and resourcing, a problem echoed by the implementation barrier themes in Section 2.5 regarding resources, reimbursement, and workflows. This review is based on a broad corpus of evidence spanning process-focused, technology-driven, and interdisciplinary approaches to medication reconciliation, so it provides a fairly comprehensive picture of the domain, although several important limitations exist. There is considerable variation in study design, clinical setting, and the definitions of outcome variables ^[48]. Across the studies included here, making direct comparison of their findings difficult and preventing the calculation of an aggregated, quantitative measure of effect size.

Further, much of the evidence base comes from hospital inpatient settings, and evidence on medication reconciliation in the ambulatory setting, in community pharmacies, or in long-term care is more limited. There is a potential risk of publication bias; studies with positive implementation outcomes may be more likely to be published than those with neutral or negative outcomes. Nonetheless, these limitations do not significantly detract from the overall conclusions of this review; they should be taken as an indication that the conclusions reported here are generally indicative rather than prescriptive of precise effect sizes.

Taken together, the evidence indicates that meaningful improvement in medication reconciliation practice will require attention to protocol development, implementation of well-designed and interoperable health information systems, and active engagement of interdisciplinary teams with clear roles and responsibilities.

Furthermore, the continuing lack of specific reimbursement for medication reconciliation indicates that guidelines alone will not suffice to bridge the gap between knowledge and practice without additional policy change.

5. CONCLUSION

Medication reconciliation is a vital patient safety intervention that is proven to decrease medication discrepancies, minimize adverse drug events and enhance patient outcomes. It is estimated that more than 70% of patients experience a medication discrepancy during transitions in care. Many of these are potentially harmful.

Effective medication reconciliation processes are able to identify and correct medication discrepancies using multi-source data, HIT, and team collaboration, which helps decrease medication errors.

There continues to be room for improvement regarding Medication reconciliation across different settings in regards to protocol development, provider education, and effective utilization of technology. Factors hindering implementation efforts include lack of resources, the difficulty of incorporating new processes into established workflows, the lack of seamless communication between organizations, and varying physician buy-in and participation. Future efforts should be directed towards the commitment of the needed resources and establishment of standardized evidence-based approaches to medication reconciliation. Investment in HIT infrastructure is key, as is adequate education for all staff.

Quality metrics must also be established to ensure effective continuous monitoring and evaluation of medication reconciliation activities.

Interdisciplinary team participation, inclusive of patients is also vital for its success. Additional research is needed for best medication reconciliation processes for different settings, utilizing new technologies such as artificial intelligence and their impact on medication reconciliation, focusing on patient-centricity, and determining longer term outcome results for special patient populations. This implementation research needs continued funding and support in order to allow the translation of research into practice.

Medication reconciliation proves that medication error prevention is preferred to post error detection. The

successful establishment of comprehensive and systematic Medication reconciliation can greatly reduce harm caused by medications to patients by applying HIT, Interdisciplinary participation, and a structured framework with a focus on quality improvement. This research is compelling and will support and advance medication reconciliation throughout all settings. However, it has been seen, medication reconciliation remains to be very important patient safety initiative that gets more proof-base with modern digital health innovations. We observed that linking medication reconciliation tool with electronic methods with models including care of teams has proved a success in bettering patient safety and precision of medications, thus continue the efforts for developing better methods for the usage of medication management systems.

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