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Barriers and facilitators of medication reconciliation through the Consolidated Framework for Implementation Research (CFIR): a systematic review

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ABSTRACT: Medication reconciliation (MedRec) is an intervention that ensures patient safety during healthcare transitions. The Consolidated Framework for Implementation Research (CFIR) was applied to deduce the contextual factors that impact the adoption of MedRec. This systematic review aimed to synthesize evidence on MedRec or pharmacist-led transition-of-care interventions that applied CFIR. A systematic review was conducted according to the PRISMA guidelines. Searches were performed in PubMed, Scopus, and ScienceDirect for studies published between 2000 and 2025 that employed Boolean operators (AND/OR) with keywords ("medication reconciliation" OR "pharmacist-led transition" OR "Pharmacist Discharge Care") AND ("Consolidated Framework for Implementation Research" OR "CFIR" OR "Implementation Research"). Eligible studies were peer-reviewed, mixed-methods, or implementation research that applied the CFIR to evaluate MedRec. A total of 690 studies were identified and screened by title and abstract, followed by a full-text assessment. Six studies were considered for inclusion after full-text screening. Data were extracted and synthesized narratively, and the findings were mapped across the five CFIR domains. Key facilitators were primarily related to Intervention Characteristics, including adaptability and perceived value, and Inner Setting, including leadership engagement and a supportive organizational culture. The characteristics of individuals included clinical expertise and commitment to medication safety, while effective interprofessional communication supported the implementation across settings. Common barriers were identified within the Inner Setting and Process domains, including limited resources, unclear professional roles, insufficient training, and poor integration of MedRec into existing work flows. The Outer Setting was less frequently reported but reflected patient needs and broader system-level influences. Overall, the CFIR provides a comprehensive framework for understanding the determinants affecting the implementation of MedRec.

KEYWORDS: Consolidated Framework for Implementation Research (CFIR); medication reconciliation; patient safety; pharmacist-led interventions; transitions of care.

INTRODUCTION

Ensuring consistency throughout transitions of care (TOC), such as hospital admission, transfer, and discharge, is the goal of medication reconciliation (MedRec), a systematic procedure that involves acquiring, confirming, and recording a full and correct list of a patient's medicines [1]. Ineffective MedRec is a well-documented contributor to medication discrepancies, adverse drug events (ADEs), and preventable hospital readmissions [2]. According to previous research, 30–70 % of patients encounter medication discrepancies either at admission to the hospital or upon departure, with a large percentage being deemed clinically important [3]. The World Health Organization (WHO) has identified medication safety during transitions of care as a global priority, emphasizing MedRec as a crucial strategy for reducing avoidable medication-related harm [4].

Pharmacist-led medication reconciliation and transition-of-care interventions have been effective in reducing medication discrepancies, improving medication appropriateness, and lowering readmission rates [5]. A previous systematic review showed that pharmacist involvement can reduce clinically relevant discrepancies by more than 50% compared with usual care [6]. However, the implementation of MedRec remains inconsistent across healthcare settings. Variations in organizational culture, staffing capacity, health information technology, leadership support, and clarity of professional roles frequently hinder intervention

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fidelity, scalability, and long-term sustainability [7]. Previous studies have revealed that the major barriers to implementing MedRec include time constraints, unclear prioritization, and inadequate feedback mechanisms [8]. Medication reconciliation can significantly lower the incidence of medication errors that may arise from an incomplete or inaccurate medication history, as well as reduce the length of hospital stay, patient readmissions, and overall healthcare costs [9]. This underscores the urgency of conducting this review to identify key barriers and facilitators and to inform more effective and sustainable implementation strategies in clinical practice.

Previous effectiveness-focused research designs are limited in their ability to explain why MedRec interventions succeed in some contexts but fail in others. Implementation research addresses this gap by providing structured frameworks for examining the multilevel contextual determinants influencing adoption, implementation, and sustainability [10]. The Consolidated Framework for Implementation Research (CFIR) is one of the most widely applied frameworks in health services research [11]. The five domains of CFIR incorporate elements from many theories of implementation: intervention characteristics, outer setting, inner setting, characteristics of individuals, and process. Intervention planning, organizational preparedness, external policy pressures, personal views and expertise, and implementation strategies have all been systematically identified as either helping or hindering factors using this framework [12], [13]. Importantly, CFIR is particularly well-suited to complex, multidisciplinary interventions such as MedRec, where successful implementation depends on coordination across professional roles, workflows, and organizational boundaries [14].

In recent years, several qualitative and mixed-methods studies have applied the Consolidated Framework for Implementation Research (CFIR) to examine MedRec and pharmacist-led transition-of-care (TOC) interventions across hospitals and transitional care settings. For example, a hospital-based case study guided by CFIR identified multiple constructs influencing medication reconciliation (MR) implementation, particularly those related to Inner Setting, Characteristics of Individuals, and Intervention Characteristics, highlighting the need for clinical knowledge, teamwork, and aligned workflows to support successful implementation [15]. A dual-site qualitative evaluation of the pharmacist discharge care (PHARM-DC) intervention used the CFIR to map themes such as institutional context, adaptability, and sustainability across implementation sites, providing rich insights into the factors shaping intervention success and potential scalability [16]. Additionally, CFIR has been used to evaluate pharmacist perspectives on TOC interventions, including pharmacist, nurse, and physician views on barriers and facilitators related to communication, training, and process standardization [17]. These studies reveal how contextual factors, such as organizational culture, interprofessional collaboration, resource availability, and adaptability, influence implementation outcomes. Despite these valuable contributions, no comprehensive synthesis has systematically reviewed how CFIR has been applied in this field or summarized cross-study patterns of determinants influencing MedRec implementation.

Given the prevalence of medication mismatches, potential harm, and persistent variability in the implementation of MedRec across healthcare, there is a clear need to systematically examine the contextual factors that influence the adoption of MedRec. This systematic review addresses this gap by synthesizing CFIR-informed studies of MedRec and pharmacist-led TOC interventions to identify recurring barriers, facilitators, and implementation lessons relevant to clinical practice, health system policy, and future research. By mapping findings across CFIR domains, this review provides a comprehensive understanding of context-dependent determinants and supports the development of strategies to strengthen the effective and sustainable implementation of MedRec programs.

METHODS

Search strategy

This systematic review was conducted according to the PRISMA 2020 guidelines [18]. A comprehensive literature search was performed using three international electronic databases: ScienceDirect, Scopus, and PubMed/MEDLINE. Our goal in doing this search was to locate scholarly articles on medication reconciliation that have used the CFIR paradigm. This study compiles data based on the CFIR to identify common obstacles,

solutions, and lessons learned from implementation that may be used in clinical practice, health policy, and future studies.

The search strategy employed Boolean operators (AND/OR) to combine key concepts related to medication reconciliation, transitions of care, and implementation research. The following keywords and combinations were used: ("medication reconciliation" OR "pharmacist-led transition" OR "Pharmacist Discharge Care") AND ("Consolidated Framework for Implementation Research" OR "CFIR" OR "Implementation Research"). Searches were limited to full-text articles published in English and conducted in healthcare settings relevant to medication reconciliation and transitions of care. The search results were imported into a reference management system, and duplicate records were identified and removed prior to screening. The reference lists of the included studies were screened to identify additional relevant articles.

The literature search was conducted on December 1, 2025, primarily by FM, who was responsible for identifying and listing potentially eligible studies. To enhance comprehensiveness and minimize the risk of missing relevant studies, the search and listing processes were performed twice. All search results were imported into Rayyan systematic review software to facilitate study selection, duplicate removal, and screening. The reference lists of the included studies were manually screened to identify additional relevant articles.

Selection criteria and eligibility assessment

Selection criteria were developed to address the main research question: How has the Consolidated Framework for Implementation Research (CFIR) been applied to examine the implementation of medication reconciliation in healthcare settings. Based on the selection criteria, studies were included if they (i) were published between 2000 and 2025, (ii) reported findings from primary research, (iii) were available as full-text articles, (iv) focused on medication reconciliation or pharmacist-led transition-of-care interventions, and (v) explicitly applied the CFIR to guide data collection, analysis, or interpretation. Studies were excluded if they were published as conference abstracts, editorials, or commentaries because of a lack of detailed methodology and comprehensive data.

Following database search, duplicate records were removed prior to screening. The titles and abstracts of the remaining articles were screened to assess their relevance to the review objectives. Articles deemed potentially eligible were subjected to full-text review to confirm alignment with the inclusion criteria. FM and AEN conducted the screening and eligibility assessments. FM initially screened and shortlisted articles based on the inclusion criteria, and AEN independently rechecked the eligibility of the selected studies. Any discrepancies were resolved through discussion until a consensus was reached. To further enhance objectivity and reduce selection bias, an independent reviewer was invited to verify the final list of included studies. The final decision regarding study inclusion was made jointly by FM and AEN based on their mutual agreement. The overall study selection process is summarized in the PRISMA flowchart.

Data extraction

Data extraction was systematically performed for all eligible studies. A total of 690 studies were identified from the database searches (PubMed: 134; Scopus: 311; and ScienceDirect: 245). After the removal of 16 duplicate records, 674 articles were screened based on their titles and abstracts, resulting in the exclusion of 612 records. Sixty-two full-text articles were assessed for eligibility, of which 56 were excluded for reasons such as not applying the CFIR, not focusing on medication reconciliation, or insufficient reporting of implementation findings. Ultimately, six studies met the inclusion criteria and were included in the final systematic review.

Data extraction and synthesis were conducted collaboratively by FM and AEN, who independently identified the key findings from each study and then discussed and consolidated the results. This dual-review process was applied to ensure consistency and accuracy and minimize subjective bias in data interpretation. This selection process is illustrated in the PRISMA flow diagram (Figure 1).

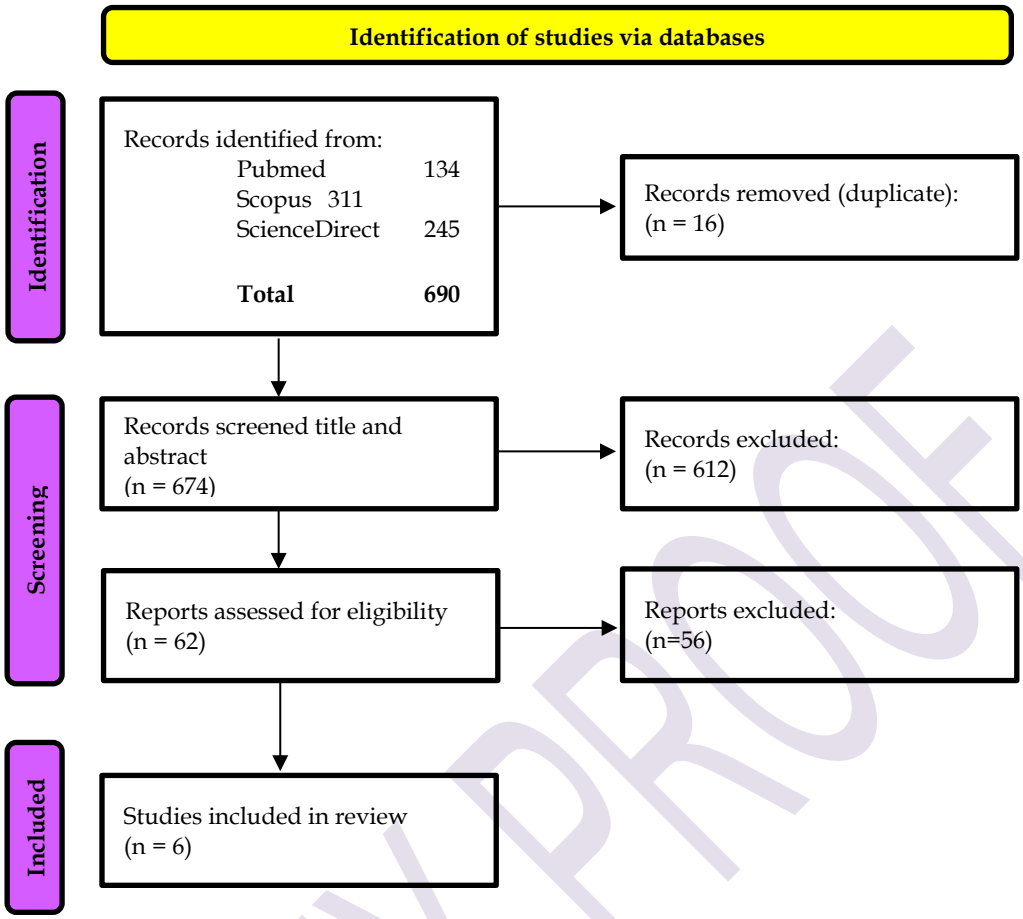

Figure 1. PRISMA flow diagram of the study identification, screening, and selection processes.

RESULTS

Following systematic database searches, six studies met the eligibility criteria and were included in the analysis (Table 1). Studies were selected based on their explicit application of the Consolidated Framework for Implementation Research (CFIR) to MedRec, pharmacist-led interventions, and transition-of-care services. This focused review enhanced the robustness of the findings by enabling a detailed examination of the application of CFIR has been applied to medication reconciliation and pharmacist-led transition-of-care interventions.

Across the included studies, as shown in Table 1, MedRec was implemented in diverse healthcare settings, including hospitals, primary care, outpatient care, and transitional care programs, primarily in the United States, but also in Qatar, Lebanon, and Brazil. Overall, the findings indicate that successful implementation is influenced by multiple interacting factors, including organizational readiness, interprofessional communication, resource availability, and pharmacist competency.

Table 1. Characteristics of the studies included in the systematic review (n = 6).

Authors (years)	Country (setting)	Study aim and design	Participants	Key finding
Al Shihab et al. (2024)	Qatar (Primary Care)	To explore key informant perspectives on establishing a pharmacist-led anticoagulation service using an interview	Healthcare center managers, pharmacy leads, physician leads, and primary care physicians	Pharmacist training and effective communication were identified as key facilitators, whereas staff shortages and resource limitations were major barriers to implementation. Participants perceived the service as having the potential to improve access to care and reduce the burden on secondary care.
Oche et al. (2024)	United States (Hospital Discharge)	To examine multidisciplinary perspectives on PHARM-DC implementation through an interview and focus group study	Pharmacists, physicians, nurses, hospital leaders, and pharmacy administrators	Facilitators included accurate medication histories, structured discharge processes, the use of electronic health record tools, and standardized training. Barriers included communication gaps with care teams and variability in pharmacists' skills, which were mitigated through educational resources.
Eddine et al. (2023)	Lebanon (Outpatient Care)	To evaluate a pharmacist-led medication review with deprescribing focus guided by implementation science	Patients 65 years or older with polypharmacy	The pharmacist-led deprescribing review revealed a high burden of drug-related problems, indicating a clear need for intervention. Patients receiving the service reported significantly higher satisfaction than those receiving usual care, although acceptance of pharmacists' recommendations by physicians was limited.
Fernandes et al. (2022)	Brazil (Hospital)	To assess the implementation of pharmacist-led medication reconciliation using a guided case study	Physicians, pharmacists, nurses, nutritionists and, a social worker	Workflow integration and institutional support enabled implementation, while limited training and inconsistent communication impeded adoption
Murry et al. (2022)	United States (Hospital Discharge)	To analyze implementation of the PHARM-DC intervention across two sites using a qualitative dual-site study	Pharmacists and pharmacy administrators	The dual-site analysis found that the PHARM-DC intervention can be successfully implemented in diverse settings by utilizing pharmacy technicians for technical tasks and adapting documentation to fit specific institutional workflows
Sanchez et al. (2014)	United States (Hospital)	To examine medication reconciliation implementation from planners' perspectives using an interview	Pharmacy directors, nurse managers, quality improvement managers, IT representatives, and physicians with administrative roles	The successful implementation requires a multidisciplinary team and a shift in focus from mere administrative compliance to monitoring the actual impact of the process on prescribing errors

The implementation findings of the six included studies were mapped across the five CFIR domains and are presented in Table 2 below to understand the systematic comparison. Overall, MedRec was perceived as adaptable and beneficial, particularly in addressing patient needs in transitional and complex care settings. Key facilitators included leadership support, organizational readiness, structured training, and strong, interprofessional collaboration. However, common barriers were identified across studies, such as limited resources, staffing constraints, communication gaps, and variability in pharmacist skills and role clarity.

Table 2. Mapping of key findings across CFIR domains in the included studies (n = 6).

Authors (years)	Intervention characteristics	Outer setting	Inner setting	Characteristics of Individuals	Process
Al Shihab et al. (2024)	Perceived clinical value of pharmacist-led anticoagulation service; complexity manageable	National workforce models; absence of reimbursement incentives	Organizational readiness; resource constraints	Professional role clarity; interprofessional trust	Planning and engagement with key informants
Oche et al. (2024)	PHARM-DC intervention adaptable but resource-intensive	High-risk discharge populations	Leadership support; staffing limitations; communication gaps	Variable awareness and buy-in across professions	Training, engagement, and execution variability
Eddine et al. (2023)	Deprescribing-focused medication review valued by patients; time-intensive	Patient needs (older adults with polypharmacy)	Limited infrastructure and reimbursement	Patient engagement; pharmacist clinical judgment	Execution and reflective evaluation
Fernandes et al. (2022)	MedRec complexity affected by workflow fit	Limited external policy drivers	Workflow integration; communication structures	Pharmacist knowledge and confidence variability	Execution challenges; lack of formal evaluation
Murry et al. (2022)	PHARM-DC adaptable across sites; perceived relative advantage	Transitional care needs	Contextual differences across sites; leadership engagement	Pharmacist expertise and role ownership	Planning, execution, and site-level adaptation
Sanchez et al. (2014)	MedRec viewed as complex planning intervention	Regulatory expectations for patient safety	Organizational culture; health IT infrastructure	Planner beliefs about MedRec value	Planning-focused implementation with limited feedback loops

▪ DISCUSSION

This systematic review synthesizes evidence from six CFIR studies to examine how medication reconciliation (MedRec) has been implemented across diverse healthcare settings. By mapping implementation findings across the five CFIR domains, this review provides a structured understanding of the contextual determinants that shape the implementation and sustainability of MedRec interventions beyond their demonstrated clinical effectiveness.

Intervention characteristics

Across the included studies, medication reconciliation (MedRec) was consistently described as a complex intervention requiring substantial clinical expertise and coordination. Accurate medication history taking and identification of discrepancies across transitions of care require advanced clinical judgment, particularly in hospital discharge settings characterized by time pressure and fragmented information [15], [19]. This perceived complexity increased workload and posed challenges to consistent implementation when staffing and role clarity were limited.

Adaptability emerged as a key characteristic across settings. Studies have reported that tailoring MedRec tools, documentation processes, and workflows to local contexts improves feasibility and acceptability [15], [16]. Flexibility in intervention design allowed alignment with existing electronic health records, discharge procedures, and staffing models, thereby reducing operational barriers and supporting broader adoption.

Perceived relative advantage varied across professional groups and influenced their engagement. Pharmacists consistently recognized MedRec as a clinically meaningful patient safety intervention, whereas some physicians and nurses viewed it as an administrative or duplicative task [15], [19]. Perceived relative advantage varied across professional groups. Pharmacists strongly value the clinical contribution of the service, whereas some physicians express concerns regarding role overlap and prescribing authority [20]. These differing perceptions underscore the importance of clearly articulating the clinical purpose and value of MedRec to promote a shared understanding and multidisciplinary participation during implementation.

These findings align with the broader non-CFIR MedRec literature, which similarly identifies intervention complexity and unclear role delineation as major barriers to implementation. However, the CFIR-informed studies included in this review provide a more nuanced explanation by demonstrating how perceived complexity interacts with contextual constraints, such as workflow design and staffing, to influence the implementation fidelity. This suggests that complexity alone is not prohibitive; rather, it becomes a barrier when it is not supported by adaptive systems and clear professional roles.

Outer setting

Across the included studies, patient needs and resources were the most consistently reported outer setting determinants influencing MedRec implementation. High-risk populations, particularly older adults, patients with polypharmacy, and those experiencing frequent care transitions, reinforce the perceived importance of MedRec and pharmacist-led TOC services [16], [21]. These patient characteristics increased clinical urgency and justified the prioritization of MedRec in hospital and transitional care contexts. Alshihab et al. also highlighted patient needs as a strong external driver for implementation, particularly for populations requiring close medication monitoring and continuity of care [20].

Despite recognition of patient needs, external policy and incentive structures were limited across settings. Several studies have reported the absence of reimbursement mechanisms, formal mandates, or performance indicators tied to MedRec, which constrained organizational investment and long-term sustainability [15], [19]. This lack of external pressure reduces the leadership's motivation to allocate protected time and staffing.

Inter-organizational relationships and system-level coordination were infrequently examined, suggesting that outer setting determinants remain underexplored in CFIR-informed MedRec studies. Limited coordination between hospital and community care settings hinders continuity after discharge [16]. This gap highlights the need for future studies to explicitly examine the policy, payment, and cross-sector influences on MedRec implementation.

This gap contrasts with non-CFIR studies, which often emphasize system-level fragmentation, particularly poor integration between hospitals and primary care, as a key driver of post-discharge medication discrepancies. The limited attention to these factors within CFIR applications suggests a potential underutilization of the framework's outer setting domains. Future research should explicitly incorporate policies, reimbursement, and cross-sector coordination to better capture the complexity of real-world implementation. From a policy perspective, the consistent absence of reimbursement mechanisms in previous studies highlights a critical structural barrier. Embedding MedRec into national quality indicators or value-based care models may provide the necessary external incentives to support its sustained implementation.

Inner setting

The Inner Setting domain emerged as one of the most influential determinants, with leadership engagement being identified as a critical facilitator. Studies have demonstrated that visible managerial support and alignment with institutional patient safety priorities enabled MedRec to be embedded into routine workflows [16],[19]. Leadership endorsement legitimizes pharmacist involvement and supports interprofessional collaboration. This is consistent with the findings of Alshihab et al., who identified leadership engagement as a critical facilitator [20].

Organizational culture further shapes implementation success. Settings characterized by a collaborative, safety-oriented culture demonstrated greater acceptance of pharmacist-led MedRec interventions and more effective interprofessional teamwork [15]. In contrast, hierarchical structures and rigid professional boundaries limit communication and hinder shared responsibility for medication reconciliation, reducing the effectiveness of its implementation.

Conversely, resource constraints, including staffing shortages, time limitations, and competing clinical demands, have been consistently reported as major barriers [15],[17]. These limitations restrict pharmacists' capacity to perform comprehensive reconciliation, particularly during peak admission and discharge periods, thereby reducing intervention reach and consistency.

Access to information and communication infrastructure also plays a central role. The integration of MedRec into electronic health records and discharge systems has facilitated coordination and continuity, whereas fragmented documentation has hindered implementation and sustainability [17],[19]. These findings underscore the importance of organizational readiness and supportive infrastructures.

Compared with non-CFIR MedRec studies, which frequently report similar barriers (e.g., time constraints and workload), this review provides a deeper insight into how these barriers are embedded within organizational systems. Specifically, resource limitations are not isolated issues but are closely linked to leadership prioritization, workflow integration and institutional culture. This reinforces the need for system-level interventions rather than isolated training or staffing.

For practice, these findings suggest that healthcare organizations should prioritize integrating MedRec into existing workflows and digital systems, rather than treating it as an additional task. Organizational readiness assessments may be a critical first step prior to implementation.

Characteristics of individuals

Individual-level determinants have been prominently reported across studies, particularly professional knowledge, skills, and beliefs. Pharmacists were consistently identified as key implementers due to their expertise in medication management; however, variability in clinical confidence and experience influenced intervention fidelity [15], [17]. Therefore, targeted training and experiential learning are critical for supporting consistent practice.

Beliefs regarding the value of MedRec differed across professional groups. Pharmacists generally view MedRec as a core patient safety intervention, while some physicians and nurses perceive it as an administrative or duplicative task [15],[19]. These differences affect engagement and responsiveness to pharmacist recommendations.

Communication skills and professional identity also shaped the implementation process. Studies have reported that pharmacists who are confident in interprofessional communication are more effective in resolving discrepancies and influencing prescribing decisions [17]. Conversely, limited confidence reduced pharmacists' willingness to challenge medication prescriptions.

Patient-related characteristics were less frequently examined but provided important insights into the disease. Where assessed, patients receiving pharmacist-led medication reviews reported high satisfaction and perceived benefits, even when physician acceptance of recommendations was variable [21]. This finding underscores the importance of incorporating patient perspectives into MedRec implementation strategies.

The findings highlight a critical but often underexplored issue in MedRec implementation: the influence of professional identity and interprofessional dynamics on MedRec. While non-CFIR studies acknowledge resistance from physicians, CFIR-based analyses better explain this through constructs such as beliefs, self-efficacy, and role clarity. Addressing these factors may require interprofessional education and role negotiation strategies, rather than solely focusing on pharmacist training.

Additionally, the limited integration of patient perspectives represents missed opportunities. Incorporating patient engagement strategies may enhance implementation success and clinical outcomes.

Process

Process-related determinants varied across studies but were critical for successful implementation. Early and structured planning activities, particularly those involving multidisciplinary stakeholders, supported the alignment of MedRec with existing clinical workflows and clarified professional roles [16], [19]. Collaborative planning enabled organizations to anticipate operational challenges, tailor implementation strategies, and establish shared expectations regarding the scope and purpose of MedRec.

Stakeholder engagement throughout the implementation process was critical for fostering ownership and reducing resistance. The active involvement of pharmacists, physicians, nurses, and administrative leaders facilitated the acceptance of pharmacist-led MedRec interventions and promoted interprofessional collaboration [19]. Conversely, the limited engagement of non-pharmacy professionals contributes to role ambiguity and reduced responsiveness to pharmacist recommendations, particularly during care transitions [15].

Execution strategies varied across settings and directly influenced the fidelity of the intervention. Structured training programs and standardized educational resources were effective in reducing variability in pharmacists' skills and supporting the consistent delivery of MedRec [17]. In addition, the use of standardized workflows and electronic health records–embedded processes facilitated integration into routine care, whereas reliance on informal practices limited the scalability and consistency of these programs [16].

Reflecting and evaluating were less consistently addressed across the studies. Several reports have noted the limited use of formal monitoring, feedback, or audit mechanisms to assess implementation quality or outcomes, constraining opportunities for continuous improvement [15]. The absence of systematic evaluation reduces organizations' ability to adapt interventions over time and demonstrate value, highlighting the importance of embedding ongoing assessment within MedRec implementation strategies.

In summary, the implementation of medication reconciliation was shaped by interrelated determinants across all five CFIR domains. Intervention Characteristics highlight the need for adaptable yet clinically robust models to address the inherent complexity of MedRec. Inner Setting factors, particularly leadership engagement, resource availability, and workflow integration, emerged as the most influential determinants of implementation success. Characteristics of Individuals underscore the central role of pharmacists' expertise and the importance of a shared understanding among multidisciplinary teams. Although less frequently examined, Outer Setting influences, such as patient needs and system-level incentives, remain relevant to sustainability. Finally, Process-related determinants emphasize the importance of structured planning, training, and ongoing evaluation to support the consistent delivery and long-term integration of MedRec interventions.

Future research should expand beyond hospital settings to include cross-sector transitions and should utilize the CFIR outer setting domain to capture policy and system-level influences. Additionally, comparative studies between CFIR-informed and non-CFIR implementation approaches may further clarify the value of implementation frameworks in improving MedRec outcomes.

▪ CONCLUSION

Effective implementation of medication reconciliation (MedRec) depends on the alignment of individual competencies, organizational context, external influences, and the structured implementation processes. MedRec is not only a technical effort, according to the reviewed evidence, but also a complicated invention requiring interprofessional cooperation, leadership support, and adaptable implementation techniques. Sustainable scale-up across multiple healthcare systems should be supported by future research that prospectively applies the CFIR to create implementation methods, link factors to quantifiable outcomes, and more.

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