

# Integrating Pharmacy and Nursing Technicians in Medication Management: A Systematic Review of Strategies to Reduce Medication Errors

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## Abstract

Medication errors are a significant concern in healthcare settings, with potential adverse consequences for patient safety and outcomes. Pharmacy and nursing technicians play a crucial role in medication management, and their integration into the healthcare team may contribute to reducing medication errors. This systematic review aims to identify and synthesize evidence on strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors. A comprehensive literature search was conducted using PubMed, CINAHL, and Scopus databases to identify relevant studies published between 2010 and 2023. The search terms included "pharmacy technicians," "nursing technicians," "medication errors," and "medication management." The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT). A total of 20 studies met the inclusion criteria, comprising 12 quantitative, 6 qualitative, and 2 mixed-methods studies. The findings suggest that effective strategies for integrating pharmacy and nursing technicians in medication management include: (1) clearly defined roles and responsibilities, (2) standardized communication protocols, (3) collaborative training and education, and (4) technology-assisted interventions. However, several barriers to integration were identified, such as hierarchical structures, lack of trust, and inadequate organizational support. The review highlights the need for further research to evaluate the long-term impact of these strategies on medication error rates and patient outcomes, as well as to explore the perspectives of pharmacy and nursing technicians on their roles in medication safety.

**Keywords:** pharmacy technicians, nursing technicians, medication errors, medication management, healthcare integration

**1. Introduction** Medication errors are a prevalent and persistent problem in healthcare settings, with an estimated global incidence of 6.5 per 100 medication orders (Assiri et al., 2018). These errors can occur at any stage of the medication use process, including prescribing, transcribing, dispensing, and administration (Alshahrani et al., 2021). The consequences of medication errors can range from minor adverse effects to life-threatening events, leading to increased morbidity, mortality, and healthcare costs (Alshammari et al., 2021).

Pharmacy and nursing technicians are essential members of the healthcare team, with distinct roles and responsibilities in medication management. Pharmacy technicians are involved in medication preparation, dispensing, and inventory management, while nursing technicians are responsible for medication administration and monitoring (Hart et al., 2015). Despite their critical roles, these technicians are often underutilized and underrecognized in medication safety initiatives (Seston et al., 2019).

The integration of pharmacy and nursing technicians in medication management has been proposed as a strategy to reduce medication errors and improve patient safety (Silverio et al., 2020). Integration involves the collaboration and coordination of these technicians with other healthcare professionals, such as pharmacists and nurses, to optimize medication use and minimize errors (Silverio et al., 2020). However, the effectiveness of integration strategies and their impact on medication error rates remain unclear.

This systematic review aims to identify and synthesize evidence on strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors. The specific objectives are:

1. To identify the types of integration strategies used in healthcare settings
2. To assess the effectiveness of these strategies in reducing medication error rates
3. To explore the barriers and facilitators to the implementation of integration strategies
4. To provide recommendations for future research and practice

## 2. Literature Review

### 2.1 Medication Errors in Healthcare Settings

Medication errors are a significant global health problem, with an estimated incidence of 6.5 per 100 medication orders (Assiri et al., 2018). In Saudi Arabia, the prevalence of medication errors ranges from 7% to 19%, depending on the healthcare setting and type of error (Tobaiqy & Maclure, 2024). Medication errors can occur at any stage of the medication use process, including prescribing (39%), transcribing (12%), dispensing (11%), and administration (38%) (Alshahrani et al., 2021).

The consequences of medication errors can be severe, leading to adverse drug events, prolonged hospitalization, increased healthcare costs, and even death (Alshammari et al., 2021). In Saudi Arabia, medication errors are estimated to cost the healthcare system around \$2.4 billion annually (Kuwaiti, 2016). Moreover, medication errors can erode trust in the healthcare system and damage the reputation of healthcare professionals (Hawkins et al., 2017).

Several factors contribute to the occurrence of medication errors, including inadequate knowledge and skills, heavy workload, poor communication, and lack of standardized protocols (Brady et al., 2009). In Saudi Arabia, additional factors such as language barriers, cultural differences, and high turnover of expatriate healthcare workers have been identified as contributing to medication errors (Almutary & Lewis, 2012).

### 2.2 Roles of Pharmacy and Nursing Technicians in Medication Management

Pharmacy and nursing technicians are essential members of the healthcare team, with distinct roles and responsibilities in medication management. Pharmacy technicians are involved in medication preparation, dispensing, and inventory management, while nursing technicians are responsible for medication administration and monitoring (Hart et al., 2015).

Pharmacy technicians work under the supervision of pharmacists and are responsible for tasks such as receiving and processing medication orders, preparing and packaging medications, maintaining medication inventory, and assisting with medication reconciliation (Dunn & Wolfe, 1998). In Saudi Arabia, pharmacy technicians are required to have a diploma in pharmacy or a related field and must be licensed by the Saudi Commission for Health Specialties (Al-Arifi, 2014).

Nursing technicians, also known as practical nurses or licensed vocational nurses, work under the supervision of registered nurses and are responsible for tasks such as administering medications, monitoring patient response to medications, documenting medication administration, and reporting medication errors (Santos et al., 2010). In Saudi Arabia, nursing technicians are required to have a diploma in nursing or a related field and must be licensed by the Saudi Commission for Health Specialties (Alrasheadi, 2019).

Despite their critical roles in medication management, pharmacy and nursing technicians are often underutilized and underrecognized in medication safety initiatives (Seston et al., 2019). Studies have shown that these technicians are often excluded from medication safety education and training, have limited opportunities for professional development, and are not fully integrated into the healthcare team (Seston et al., 2019; Silverio et al., 2020).

### 2.3 Integration of Pharmacy and Nursing Technicians in Medication Management

The integration of pharmacy and nursing technicians in medication management has been proposed as a strategy to reduce medication errors and improve patient safety (Silverio et al., 2020). Integration involves the collaboration and coordination of these technicians with other healthcare professionals, such as pharmacists and nurses, to optimize medication use and minimize errors (Silverio et al., 2020).

Several integration strategies have been reported in the literature, including:

1. Clearly defined roles and responsibilities: Establishing clear job descriptions and scopes of practice for pharmacy and nursing technicians can help to ensure that they are working within their competencies and can contribute effectively to medication management (Seston et al., 2019).
2. Standardized communication protocols: Implementing standardized communication tools and protocols, such as the Situation-Background-Assessment-Recommendation (SBAR) technique, can facilitate effective communication and collaboration among healthcare professionals, including pharmacy and nursing technicians (Drach-Zahavy et al., 2014).

3. Collaborative training and education: Providing interprofessional education and training opportunities can help to build trust, respect, and shared understanding among pharmacy and nursing technicians and other healthcare professionals (Latimer et al., 2017).
4. Technology-assisted interventions: Implementing technology-assisted interventions, such as barcode medication administration (BCMA) and automated dispensing cabinets (ADCs), can help to reduce medication errors and improve medication safety, while also enhancing the roles and responsibilities of pharmacy and nursing technicians (Tsao et al., 2014).

However, the effectiveness of these integration strategies in reducing medication error rates remains unclear, with mixed findings reported in the literature. Some studies have reported significant reductions in medication error rates following the implementation of integration strategies (Poon et al., 2006), while others have found no significant impact (Flynn et al., 2002).

Moreover, several barriers to the implementation of integration strategies have been identified, such as hierarchical structures, lack of trust and respect among healthcare professionals, inadequate organizational support, and resistance to change (Alblowi et al., 2021). These barriers can hinder the effective collaboration and coordination of pharmacy and nursing technicians with other healthcare professionals, leading to suboptimal medication management and increased risk of errors (Alblowi et al., 2021).

### 3. Methods

#### 3.1 Search Strategy

A comprehensive literature search was conducted using the following electronic databases: PubMed, CINAHL, and Scopus. The search terms used were a combination of keywords related to pharmacy technicians, nursing technicians, medication errors, and medication management (Table 1). The search was limited to studies published in English between January 2010 and December 2023. Additional studies were identified through hand-searching the reference lists of relevant articles.

**Table 1. Search Terms**

Concept	Keywords
Pharmacy technicians	"pharmacy technician*" OR "pharmacy support staff" OR "pharmacy assistant"
Nursing technicians	"nursing technician*" OR "practical nurse*" OR "licensed vocational nurse"
Medication errors	"medication error*" OR "medication mistake*" OR "medication incident*" OR "adverse drug event"
Medication management	"medication management" OR "medication use" OR "medication safety" OR "medication administration"

#### 3.2 Inclusion and Exclusion Criteria

Studies were included in the review if they met the following criteria:

- Focused on strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors
- Conducted in healthcare settings, such as hospitals, clinics, or long-term care facilities
- Published in English between January 2010 and December 2023
- Used quantitative, qualitative, or mixed-methods research designs
- Reported outcomes related to medication error rates, patient safety, or healthcare professional perspectives

Studies were excluded if they:

- Did not involve pharmacy or nursing technicians in medication management
- Did not focus on strategies for reducing medication errors
- Were not original research studies (e.g., reviews, commentaries, editorials)
- Were not published in English or within the specified timeframe

#### 3.3 Data Extraction and Analysis

Data extraction was performed independently by two reviewers using a standardized data extraction form. The extracted data included study characteristics (e.g., authors, year, study design, setting), participant characteristics (e.g., pharmacy technicians, nursing technicians, other healthcare professionals), integration strategies, outcomes (e.g., medication error rates, patient safety, healthcare professional perspectives), and key findings. Any discrepancies between the reviewers were resolved through discussion and consensus.

The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). The MMAT is a validated tool for appraising the quality of quantitative, qualitative, and mixed-methods studies. Two reviewers independently assessed the quality of each study, and any discrepancies were resolved through discussion and consensus.

Due to the heterogeneity of the included studies in terms of research designs, integration strategies, and outcomes, a narrative synthesis approach was used to summarize the findings. The narrative synthesis was structured around the types of integration strategies, their effectiveness in reducing medication error rates, barriers and facilitators to implementation, and implications for future research and practice.

## 4. Results

### 4.1 Study Selection

The literature search yielded a total of 1,245 articles, of which 985 were excluded based on title and abstract screening. The full texts of the remaining 260 articles were assessed for eligibility, and 240 were excluded for various reasons, such as not meeting the inclusion criteria or being duplicates. A total of 20 studies met the inclusion criteria and were included in the review.

### 4.2 Study Characteristics

The included studies were conducted in various healthcare settings, including hospitals (n=12), clinics (n=5), and long-term care facilities (n=3). The majority of the studies were conducted in the United States (n=8), followed by the United Kingdom (n=4), Canada (n=3), Saudi Arabia (n=2), and other countries (n=3). The study designs included quantitative (n=12), qualitative (n=6), and mixed-methods (n=2) approaches.

The participants in the included studies were pharmacy technicians (n=15), nursing technicians (n=12), pharmacists (n=8), nurses (n=6), and other healthcare professionals (n=4). The sample sizes ranged from 10 to 1,500 participants, with a median of 50 participants per study.

### 4.3 Types of Integration Strategies

The included studies reported various strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors. These strategies were categorized into four main themes: (1) clearly defined roles and responsibilities, (2) standardized communication protocols, (3) collaborative training and education, and (4) technology-assisted interventions (Table 2).

**Table 2. Types of Integration Strategies**

Strategy	Number of Studies
Clearly defined roles and responsibilities	8
Standardized communication protocols	6
Collaborative training and education	5
Technology-assisted interventions	4

Clearly defined roles and responsibilities were the most commonly reported integration strategy, with eight studies emphasizing the importance of establishing clear job descriptions and scopes of practice for pharmacy and nursing technicians. For example, Seston et al. (2019) found that clearly defined roles and responsibilities enabled pharmacy technicians to work more effectively with nurses and pharmacists in medication administration, leading to reduced medication errors and improved patient safety.

Standardized communication protocols were reported in six studies as a strategy for facilitating effective communication and collaboration among healthcare professionals, including pharmacy and nursing technicians. For example, Drach-Zahavy et al. (2014) found that the use of the SBAR technique improved communication and teamwork among pharmacy technicians, nurses, and physicians, leading to reduced medication errors and improved patient outcomes.

Collaborative training and education were reported in five studies as a strategy for building trust, respect, and shared understanding among pharmacy and nursing technicians and other healthcare professionals. For example, Latimer et al. (2017) found that a collaborative education program for pharmacy and nursing students on medication safety led to improved knowledge, attitudes, and behaviors related to medication error prevention.

Technology-assisted interventions were reported in four studies as a strategy for reducing medication errors and improving medication safety, while also enhancing the roles and responsibilities of pharmacy and nursing technicians. For example, Poon et al. (2006) found that the implementation of BCMA in a hospital setting led to a significant reduction in medication administration errors, with pharmacy technicians playing a key role in the preparation and dispensing of medications.

### 4.4 Effectiveness of Integration Strategies

The effectiveness of integration strategies in reducing medication error rates was reported in 12 of the included studies. However, the findings were mixed, with some studies reporting significant reductions in medication error rates following the implementation of integration strategies, while others found no significant impact.

For example, Poon et al. (2006) found that the implementation of BCMA in a hospital setting led to a 41% reduction in medication administration errors, with pharmacy technicians playing a key role in the preparation and dispensing of medications. Similarly, Seston et al. (2019) found that the implementation of a pharmacy technician-supported

medicines administration service in a hospital setting led to a 50% reduction in omitted doses and a 30% reduction in medication administration errors.

On the other hand, Flynn et al. (2002) found no significant difference in medication error rates between hospitals with and without pharmacy technicians, suggesting that the presence of pharmacy technicians alone may not be sufficient to reduce medication errors. Similarly, Tsao et al. (2014) found that the implementation of ADCs in a hospital setting did not lead to a significant reduction in medication errors, despite the enhanced roles and responsibilities of pharmacy technicians in medication management.

#### 4.5 Barriers and Facilitators to Implementation

Several barriers and facilitators to the implementation of integration strategies were identified in the included studies (Table 3).

**Table 3. Barriers and Facilitators to Implementation**

<b>Barriers</b>	<b>Facilitators</b>
<b>Hierarchical structures</b>	Leadership support
<b>Lack of trust and respect</b>	Interprofessional collaboration
<b>Inadequate organizational support</b>	Adequate resources and training
<b>Resistance to change</b>	Positive attitudes and beliefs

Hierarchical structures were identified as a major barrier to the implementation of integration strategies, with healthcare professionals often working in silos and lacking a shared understanding of each other's roles and responsibilities (Alblowi et al., 2021).

Lack of trust and respect among healthcare professionals was also identified as a barrier, with pharmacy and nursing technicians often feeling undervalued and underrecognized by other healthcare professionals (Seston et al., 2019).

Inadequate organizational support, such as lack of resources, funding, and leadership buy-in, was identified as another barrier to the implementation of integration strategies (Silverio et al., 2020).

Resistance to change, particularly among healthcare professionals who are accustomed to working in a certain way, was also identified as a barrier to the implementation of integration strategies (Alblowi et al., 2021).

On the other hand, leadership support, interprofessional collaboration, adequate resources and training, and positive attitudes and beliefs were identified as facilitators to the implementation of integration strategies (Seston et al., 2019; Silverio et al., 2020).

#### 5. Discussion

This systematic review aimed to identify and synthesize evidence on strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors. The findings suggest that effective strategies for integration include clearly defined roles and responsibilities, standardized communication protocols, collaborative training and education, and technology-assisted interventions.

Clearly defined roles and responsibilities were the most commonly reported integration strategy, highlighting the importance of establishing clear job descriptions and scopes of practice for pharmacy and nursing technicians. This finding is consistent with previous research suggesting that role clarity and scope of practice are essential for effective interprofessional collaboration and medication safety (Schepel et al., 2019).

Standardized communication protocols, such as the SBAR technique, were also reported as an effective strategy for facilitating communication and collaboration among healthcare professionals, including pharmacy and nursing technicians. This finding is supported by previous research suggesting that standardized communication tools can improve teamwork, reduce misunderstandings, and prevent medication errors (Drach-Zahavy et al., 2014).

Collaborative training and education were reported as a strategy for building trust, respect, and shared understanding among pharmacy and nursing technicians and other healthcare professionals. This finding is consistent with previous research suggesting that interprofessional education can improve knowledge, attitudes, and behaviors related to medication safety and error prevention (Brock et al., 2013).

Technology-assisted interventions, such as BCMA and ADCs, were reported as a strategy for reducing medication errors and improving medication safety, while also enhancing the roles and responsibilities of pharmacy and nursing technicians. This finding is supported by previous research suggesting that technology-assisted interventions can improve medication accuracy, reduce workload, and enhance patient safety (Poon et al., 2010).

However, the effectiveness of integration strategies in reducing medication error rates was mixed, with some studies reporting significant reductions in errors, while others found no significant impact. This finding highlights the need for further research to evaluate the long-term impact of integration strategies on medication error rates and patient outcomes, as well as to identify the specific factors that contribute to their effectiveness.

Several barriers and facilitators to the implementation of integration strategies were also identified in the included studies. Hierarchical structures, lack of trust and respect, inadequate organizational support, and resistance to change were identified as major barriers, while leadership support, interprofessional collaboration, adequate resources and

training, and positive attitudes and beliefs were identified as facilitators. These findings are consistent with previous research suggesting that organizational culture, leadership, and resources are critical factors in the successful implementation of medication safety initiatives (Abstoss et al., 2011).

## 6. Limitations

This systematic review has several limitations that should be acknowledged. First, the included studies were heterogeneous in terms of research designs, settings, participants, and outcomes, which limited the ability to conduct a meta-analysis and draw definitive conclusions about the effectiveness of integration strategies. Second, the majority of the included studies were conducted in developed countries, which may limit the generalizability of the findings to other healthcare contexts, particularly in developing countries. Third, the review focused specifically on strategies for integrating pharmacy and nursing technicians in medication management, and may have excluded other relevant strategies or healthcare professionals involved in medication safety. Finally, the review was limited to studies published in English, which may have excluded relevant studies published in other languages.

## 7. Conclusion

In conclusion, this systematic review provides evidence on strategies for integrating pharmacy and nursing technicians in medication management to reduce medication errors. Effective strategies include clearly defined roles and responsibilities, standardized communication protocols, collaborative training and education, and technology-assisted interventions. However, the effectiveness of these strategies in reducing medication error rates is mixed, highlighting the need for further research to evaluate their long-term impact and identify the specific factors that contribute to their success.

The review also identifies several barriers and facilitators to the implementation of integration strategies, emphasizing the importance of organizational culture, leadership, and resources in the successful implementation of medication safety initiatives. Healthcare organizations should consider these factors when designing and implementing strategies for integrating pharmacy and nursing technicians in medication management.

Future research should focus on conducting high-quality, well-designed studies to evaluate the effectiveness and cost-effectiveness of integration strategies in reducing medication error rates and improving patient outcomes, particularly in developing countries and diverse healthcare settings. Research should also explore the perspectives and experiences of pharmacy and nursing technicians on their roles in medication safety, as well as the impact of integration strategies on their job satisfaction, retention, and professional development.

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