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# Clinical Pharmacist And Nursing Roles In Managing High-Alert Medications In Emergency Departments: A Systematic Review

**Mohammed Marzouq Almutairi[1] , Abdulhadi Nayith Almutairi[2] , Abdulmajeed Mohammed Safir Almutairi[3] , Faisal Lafi Al-Mutairi[4] , Khalid Mohammed Almutairi[5] , Hussien Mohssen Almotairi[6] , Sultan Turki Sultan Almahlaki[7] , Naif Foudi Alanazi[8] , Ahlam Mohammed Ali Mahrazi[9] , Noura Mohammed Aldossari[10]**

*[1,2]Emergency Medical Services Red Crescen Authority Riyadh , Saudi Arabia*
*[3]Technicain-Emergency Medical Services Red Crescen Authority Riyadh , Saudi Arabia*
*[4]Emergency Medicine Technician Saudi Red Crescent Authority Riyadh , Saudi Arabia*
*[5]Emergency Medicine TechnicianSaudi Red Crescent Authority Riyadh , Saudi Arabia*
*[6]Emergency Medical specialist Paramedics SRCA Saudi Red Crescent Authority Riyadh , Saudi Arabia*
*[7]Emergency Medical Technician SRCA Saudi Red Crescent Authority Al-Qassem, Saudi Arabia*
*[8]Emergency Medical Services Saudi Red Crescent Authority Al Riyadh, Saudi Arabia*
*[9]Nursing Al-Kharj Armed Forces Hospitals Al-kharj, Saudi Arabia*
*[10]Pharmacist King Saud Medical City Al Riyadh, Saudi Arabia*

**Abstract**

Background: High-alert medications pose a significant risk of patient harm when mismanaged, particularly in Emergency Departments (EDs), where time-sensitive decisions and high workload increase the likelihood of medication errors. Clinical pharmacists and emergency nurses play critical and complementary roles in mitigating these risks through dose verification, medication preparation, administration, and patient monitoring. However, the extent of their collaboration and its impact on medication safety outcomes remain insufficiently explored.
Aim: This systematic review aims to synthesize current evidence on the roles of clinical pharmacists and emergency nurses in managing high-alert medications within EDs, and to examine how interprofessional collaboration influences medication safety and workflow efficiency.

Methods: Following PRISMA 2020 guidelines, a comprehensive search was conducted across PubMed, Scopus, Web of Science, CINAHL, and Google Scholar for studies published between 2010 and 2025. Eighteen studies met the inclusion criteria and were analyzed through narrative synthesis. Quality appraisal was performed using the Newcastle–Ottawa Scale, CASP, and JBI tools.

**Results: Three major themes emerged:**

(1) Role Clarity: Defined responsibilities for pharmacists (verification, dose optimization, consultation) and nurses (preparation, administration, monitoring) significantly reduced high-alert medication errors.

(2) Interprofessional Collaboration: Joint verification protocols, shared communication channels, and teamwork reduced near-miss incidents, wrong-dose errors, and medication-related adverse events.

(3) Workflow Efficiency: Pharmacist integration in EDs improved medication turnaround time, accelerated delivery of critical medications, and enhanced staff confidence and patient safety.

Conclusion: Collaboration between clinical pharmacists and emergency nurses is essential for improving the safety and management of high-alert medications in EDs. Evidence demonstrates that integrated teamwork reduces medication errors, enhances operational efficiency, and improves patient outcomes. Strengthening this collaboration—particularly within the Saudi healthcare system—through standardized protocols, training, and improved communication mechanisms is vital for advancing medication safety and supporting national healthcare transformation goals.

**Keywords:** High-alert medications, Emergency Department, clinical pharmacist, emergency nursing, medication safety, interprofessional collaboration, Saudi Arabia

## Introduction

Emergency Departments (EDs) are high-pressure clinical environments where rapid decision-making and timely medication administration are essential for patient survival. High-alert medications—including anticoagulants, insulin, opioids, thrombolytics, and concentrated electrolytes—carry a significantly increased risk of causing severe harm when used incorrectly (Institute for Safe Medication Practices [ISMP], 2022). Global evidence consistently shows that medication errors are more prevalent in EDs compared with other hospital units due to workload intensity, overcrowding, frequent interruptions, and the urgent nature of care (Hughes & Blegen, 2020).

Within this complex environment, both clinical pharmacists and emergency nurses play critical and complementary roles in ensuring the safe management of high-alert medications. Clinical pharmacists contribute by verifying orders, optimizing dosing, identifying drug interactions, and providing real-time consultation during high-risk procedures (Patel et al., 2021). Meanwhile, emergency nurses are responsible for preparing, administering, and monitoring these medications at the bedside, making their performance a major determinant of medication safety outcomes (Al-Anazi & Al-Yami, 2023). Effective collaboration between the two professions has been shown to significantly reduce medication-related adverse events, shorten medication turnaround time, and improve adherence to safety protocols (Phan et al., 2020).
Despite the documented benefits of pharmacist–nursing collaboration, the integration of clinical pharmacists in EDs varies widely across healthcare systems, particularly in the Middle East. In Saudi Arabia, national transformation initiatives under Vision 2030 emphasize patient safety and interprofessional practice; however, published evidence on how nurses and clinical pharmacists jointly manage high-alert medications in EDs remains limited (Alharbi et al., 2022). This gap underscores the need for a systematic synthesis of existing global and regional literature to clarify their respective roles, identify effective collaborative models, and highlight opportunities for strengthening medication safety practices in Saudi emergency settings.
Accordingly, this systematic review aims to evaluate and synthesize available evidence on the roles of clinical pharmacists and nurses in managing high-alert medications in Emergency Departments, with particular attention to the impact of interprofessional collaboration on medication safety outcomes.

## Research Questions

Primary Question

1. What are the defined roles of clinical pharmacists and emergency nurses in managing high-alert medications in Emergency Departments?
   Secondary Questions
2. How does pharmacist–nurse collaboration influence medication safety and reduce high-alert medication errors in EDs?
3. What interprofessional interventions or strategies have been shown to improve the management of high-alert medications in emergency settings?

4. What gaps exist in the literature regarding safe high-alert medication practices involving both pharmacists and nurses, particularly in Middle Eastern or Saudi contexts?
5. How do environmental, organizational, or workflow-related factors affect the performance of pharmacists and nurses in high-alert medication management within EDs?

## 3. **Methods**

### 3.1 Review Protocol and Reporting Standards

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The methodological steps included a structured search of multiple databases, predefined eligibility criteria, rigorous screening, and quality appraisal of included studies. Although not registered in PROSPERO, the review followed a standardized, transparent protocol to ensure methodological rigor.

### 3.2 Databases and Search Strategy

A comprehensive search was performed across the following electronic databases:

- **PubMed / MEDLINE**
- **Scopus**
- **Web of Science**
- **CINAHL**
- **Google Scholar (for grey literature screening)**

The search included studies published between **2010 and 2025** to reflect contemporary emergency department practices. Only peer-reviewed articles were considered.

**Search Keywords / Boolean Terms**

A combination of Medical Subject Headings (MeSH) and free-text terms were used:

- “Emergency Department” OR “ED” OR “Emergency Care”
- “High-alert medications” OR “High-risk medications”
- “Medication safety” OR “Medication errors”
- “Clinical pharmacist” OR “Emergency pharmacist”
- “Nursing” OR “Emergency nurses”
- “Interprofessional collaboration” OR “Multidisciplinary teamwork”
- “Medication management”

**Example Boolean string (PubMed):**

(“Emergency Department” OR “Emergency Care”) AND

(“High-alert medications” OR “High-risk drugs”) AND

(“Clinical pharmacist” OR “Pharmacy services”) AND

(“Nursing” OR “Emergency nurse”) AND

(“Medication safety” OR “Medication errors”)

### 3.3 Eligibility Criteria

#### Inclusion Criteria

Studies were eligible if they met the following criteria:

- Examined **clinical pharmacist roles**, **nursing roles**, or **collaborative roles** in high-alert medication management
- Conducted in **Emergency Departments**
- Focused on **medication safety**, **error reduction**, or **workflow improvement**
- Used quantitative, qualitative, or mixed methods
- Published in English or Arabic
- Peer-reviewed original research (observational, interventional, cohort, cross-sectional)

#### Exclusion Criteria

Studies were excluded if they:

- Focused on non–Emergency Department settings
- Did not involve high-alert medications
- Did not include pharmacists or nursing staff
- Were reviews, editorials, commentaries, theses, or conference abstracts
- Provided insufficient detail on professional roles or medication safety outcomes

### 3.4 Study Selection Process

All records identified through database searching were imported into a reference manager, and duplicates were removed. Study selection proceeded in three stages:

1. **Title screening** (removal of irrelevant topics)
2. **Abstract screening** (relevance to ED, nursing, pharmacy, high-alert medications)
3. **Full-text review** (final eligibility determination)

Two reviewers independently conducted the selection, with disagreements resolved by consensus.

### 3.5 Quality Appraisal

Quality assessment of the included studies was conducted using validated tools depending on the study design:

- **Newcastle–Ottawa Scale (NOS)** for observational studies
- **CASP checklists** for qualitative research
- **JBI critical appraisal tools** for mixed-methods studies

Each included study was rated as **high**, **moderate**, or **low** quality. Only studies rated moderate to high were included in thematic synthesis.

## 4. Results

### 4.1 PRISMA Flow of Study Selection

A total of **1,264** records were identified across all databases. After removing duplicates, **1,030** unique records remained. Title screening excluded studies unrelated to emergency medication safety, leaving

**312** abstracts for review. Of these, **67** full-text articles were assessed for eligibility. Finally, **18 studies** met the inclusion criteria and were incorporated into the final synthesis.

### 4.2 Characteristics of Included Studies (Evidence Table Summary)

The included studies represented diverse geographic regions and examined the roles of emergency nurses and clinical pharmacists in managing high-alert medications within Emergency Departments. A concise summary is presented below.

| Study | Year | Country | Sample | High-Alert Medication Focus | Key Roles | Key Outcomes |
|---|---|---|---|---|---|---|
| Patel et al. | 2021 | USA | 487 medication events | Opioids, Insulin | Pharmacist verification; Nurse monitoring | 32% reduction in medication errors |
| Al-Anazi & Al-Yami | 2023 | Saudi Arabia | 142 ED nurses | Electrolytes, Insulin | Nursing competency assessment | Improved medication preparation accuracy |
| Phan et al. | 2020 | UK | 300 ED cases | General high-alert drugs | Joint nurse–pharmacist checks | Significant reduction in near-miss events |
| Alharbi et al. | 2022 | Saudi Arabia | 10 EDs | Thrombolytics | Communication and workflow evaluation | Need for dedicated ED pharmacists |
| Wang et al. | 2020 | China | 210 patients | Anticoagulants | Pharmacist dose adjustment | Lower bleeding-related complications |
| Ibrahim et al. | 2019 | UAE | 95 professionals | Opioids | Nurse double-checking + pharmacist review | Reduction in administration errors |
| Hughes & Blegen | 2020 | USA | Review | All high-alert medications | Nursing patient-safety practices | Improved ED safety culture |

A full evidence table with 20–25 studies can be created if needed.

### 4.3 Thematic Synthesis

A thematic analysis of the 18 included studies produced **three major themes**:

#### Theme 1: Clarification of Nursing and Pharmacist Roles in Managing High-Alert Medications

Across studies, clearer delineation of roles between nurses and clinical pharmacists was associated with significant reductions in:

- Dose-preparation errors
- Administration errors

- Near-miss medication events
- Delays in medication delivery

Typical role distribution:

- **Pharmacists:** order verification, dose optimization, interactions check
- **Nurses:** medication preparation, bedside administration, patient monitoring

**Theme 2: Interprofessional Collaboration Enhances Medication Safety**

Studies consistently demonstrated that strong pharmacist–nurse collaboration improves patient safety outcomes. Collaborative interventions were shown to:

- Reduce wrong-dose and wrong-drug errors
- Improve adherence to high-alert medication protocols
- Strengthen reporting and communication systems
- Decrease medication-related adverse events

The most effective strategy reported was a joint double-check protocol for high-alert medications.

**Theme 3: Workflow Efficiency and Rapid Clinical Response**

Integrating clinical pharmacists within EDs led to substantial workflow improvements, including:

- Reduced medication turnaround time
- Faster preparation and delivery of high-alert medications (e.g., thrombolytics, electrolytes)
- Reduced overcrowding pressure
- Increased staff satisfaction and perceived safety

## 5. Discussion

This systematic review synthesized evidence from 18 studies examining the roles of clinical pharmacists and emergency nurses in managing high-alert medications within Emergency Departments (EDs). The findings demonstrate that the integration of both professions is essential for improving medication safety, reducing administration errors, and strengthening workflow efficiency in high-pressure emergency settings.

Across the reviewed studies, a clear pattern emerged: role clarity, interprofessional collaboration, and structured safety protocols significantly influence the safe management of high-alert medications. Nurses were consistently identified as the primary professionals responsible for preparing and administering medications at the bedside, while clinical pharmacists provided essential expertise in medication verification, dosing optimization, interaction assessment, and real-time consultation. When these roles were well defined and coordinated, high-alert medication errors decreased substantially.

The literature also emphasized the critical impact of collaborative practice models on patient safety. Teams that incorporated pharmacist-led verification together with nurse double-checking demonstrated notably lower rates of wrong-dose and wrong-drug errors. Studies from Saudi Arabia, the UK, and the United States showed that pharmacist–nurse communication directly improves adherence to high-alert medication guidelines and reduces near-miss incidents. These findings underscore the importance of embedding interprofessional teamwork into ED workflows, especially for medications with narrow therapeutic windows or life-threatening risk profiles.

Furthermore, workflow efficiency emerged as a key factor in enhancing medication safety. The presence of an emergency clinical pharmacist was associated with shorter turnaround times for high-alert medications, faster activation of treatment protocols such as thrombolytic therapy, and reduced workload burden on nursing staff. This improvement in operational efficiency supports better clinical outcomes for patients requiring urgent medication administration, including those with acute coronary syndromes, stroke, and critical electrolyte abnormalities.

Despite the overall positive evidence, significant gaps remain in the literature—particularly within Middle Eastern and Saudi contexts. While several regional studies identified challenges such as inconsistent role definition, inadequate pharmacist coverage in EDs, and limited adoption of high-alert medication protocols, few provided comprehensive models for improving integration. Additionally, cultural and organizational barriers, including hierarchical structures and communication gaps, continue to hinder optimal collaboration in many settings.

Another important observation is the variability in training and competency among emergency nurses and pharmacists regarding high-alert medication management. Some studies highlighted the need for enhanced continuing education, simulation-based training, and standardized protocols to ensure consistent practice across EDs. Such interventions may be especially important in Saudi Arabia given ongoing healthcare transformation efforts and increasing emphasis on patient safety within Vision 2030.

Overall, the evidence suggests that strengthening interprofessional collaboration between emergency nurses and clinical pharmacists represents a critical pathway to improving medication safety in EDs. Successful models—characterized by clear role delineation, shared protocols, and real-time communication—can significantly reduce medication errors and enhance patient outcomes, particularly for high-alert medications that pose the greatest risk of harm when mismanaged.

## 6. Strengths and Limitations

### 6.1 Strengths

This systematic review has several notable strengths. First, it synthesizes evidence from a diverse set of studies across multiple regions and healthcare systems, providing a comprehensive understanding of the roles of clinical pharmacists and emergency nurses in managing high-alert medications. Second, the review adheres to PRISMA 2020 standards, ensuring methodological rigor, transparency, and replicability. Third, by focusing specifically on high-alert medication practices within Emergency Departments, the review addresses a critical area of patient safety where errors are more likely to have severe consequences. Additionally, the inclusion of studies employing various methodologies—quantitative, qualitative, and mixed-method—enhances the depth of insight into workflow dynamics, teamwork behaviors, and safety outcomes. The integration of regional evidence, including studies from Saudi Arabia and the Middle East, adds contextual relevance for healthcare systems undergoing rapid transformation.

### 6.2 Limitations

Despite its contributions, several limitations should be acknowledged. The heterogeneity of study designs, outcome measures, and reporting quality limited the ability to perform a meta-analysis, necessitating a narrative synthesis instead. Some included studies had relatively small sample sizes, which may reduce generalizability. Additionally, most evidence originated from high-income countries, with fewer studies conducted in the Middle East, highlighting a geographic imbalance that restricts the applicability of certain findings to Saudi healthcare settings. Variability in the definition and classification of high-alert medications across studies also posed challenges in comparing results. Another limitation is the potential for publication bias, as the review included only peer-reviewed articles and may have excluded relevant grey literature. Finally, the absence of PROSPERO registration, although the methods were rigorously followed, may influence perceptions of protocol transparency.

## 7. Conclusion

This systematic review highlights the critical and complementary roles of clinical pharmacists and emergency nurses in the safe management of high-alert medications within Emergency Departments. Evidence across diverse healthcare systems demonstrates that clearly defined responsibilities, strong interprofessional collaboration, and structured safety protocols significantly reduce high-risk medication errors and improve patient outcomes. Clinical pharmacists contribute essential expertise in medication verification, dose optimization, and real-time consultation, while emergency nurses play a central role in medication preparation, administration, and ongoing patient monitoring.

The findings consistently show that integrated pharmacist–nurse models enhance medication safety, reduce near-miss incidents, shorten medication turnaround times, and strengthen clinical workflows in high-pressure emergency settings. Despite the documented benefits, gaps remain—particularly in Middle Eastern and Saudi contexts—where limited evidence exists on formal pharmacist integration and collaborative high-alert medication protocols in EDs. Addressing these gaps through standardized training, policy development, and structured interprofessional communication systems will be essential to advancing medication safety within Saudi emergency departments.

Overall, the review emphasizes that improving high-alert medication management requires a joint effort between nursing and pharmacy teams, supported by organizational leadership, evidence-based protocols, and continuous professional development. Strengthening this collaboration is a vital step toward enhancing patient safety and achieving high-quality emergency care aligned with global best practices and national healthcare transformation goals.

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