Medication Errors in Hospital Settings: Causes, Prevention Strategies, and the Role of Clinical Pharmacists

Naif Sulaiman H Asr*

[1]Pharmacy Technician, Islamic University of Madinah, Madinah, Saudi Arabia

*Corresponding author

Naif Sulaiman H Asr

ABSTRACT

Medication-related mistakes continue to pose a substantial threat to safety of patients in hospitals, where medicines pass through multiple complex stages involving prescribing, transcription, dispensing, preparation, administration, and monitoring. Errors may arise from individual actions, breakdowns in communication, poorly designed systems, work demands, inadequate training, interruptions, and limitations in medication-use technology. Although not every error cause harm, preventable events can result in adverse drug events, prolonged hospitalization, additional treatment, disability, or death. This narrative review discusses the principal types and causes of medication-related errors within hospitals, examines practical and technology-enabled prevention measures, and highlights the contribution of pharmacists with clinical responsibilities to more reliable medicine management. Evidence from reviews and hospital medication-safety guidance supports a multifaceted strategy that combines medication reconciliation, pharmacist involvement, computerized provider order entry, clinical decision support, barcode-assisted administration, standardization, staff education, and well-established reporting systems. Pharmacists with clinical responsibilities can identify prescribing problems, assess doses and interactions, support high-risk medication management, participate in ward rounds, counsel patients, and help support root-cause analysis and service improvement. Technology can strengthen safety, but it may also introduce new risks when alerts are poorly configured, workflows are mismatched, or users rely on automation without clinical judgment. An effective hospital medication-safety program therefore depends on coordinated systems, a just culture, continuous measurement, and active participation of the entire healthcare team. Pharmacists with clinical responsibilities are well positioned to connect these elements and translate medication-safety principles into everyday clinical practice.

Keywords: Medication errors; Adverse drug events; Medication reconciliation; Medication safety Hospital Patient safety; Clinical pharmacist.

1. INTRODUCTION

Medicines are central to modern hospital care, supporting treatment of acute illness, chronic disease, perioperative conditions, infections, and critical care. Their benefits, however, depend on appropriate selection, prescribing, preparation, administration, and monitoring. Medication use in hospitals is a complex process involving physicians, pharmacists, nurses, technicians, patients, caregivers, and information systems. A failure at any point can lead to an error that reaches the patient or creates the potential for harm. Medication-related errors are consequently viewed not simply as isolated mistakes, but as outcomes of interactions between people, tasks, technologies, and the institutional context [1,2]. The World Health Organization (WHO) has identified safe medication use as a global priority and launched the Medication Without Harm initiative to reduce avoidable medication-related harm [1]. The initiative emphasizes high-risk situations, polypharmacy, and transitions of care, while encouraging coordinated action across health systems. Hospitals are especially important settings for this work because patients may be acutely ill, receive many medicines, undergo frequent changes in therapy, and have limited ability to communicate their medication history. Intensive care units, emergency departments, surgical wards, and pediatric units often involve additional complexity [3].

Medication-related errors are distinct from adverse drug reactions. An adverse drug reaction may occur despite appropriate use of a medicine, whereas a medication error is a preventable failure in the medication management pathway. An adverse drug event refers to injury associated with medication

use and may arise from an error or from appropriate therapy. These terms are best used carefully because inconsistent definitions and reporting methods can make comparisons between hospitals or studies difficult [4,5]. Evidence indicates that no single intervention is sufficient to eliminate medication-related errors. Studies s have found benefits from pharmacist-led medication reconciliation, computerized prescribing, clinical decision support, barcode systems, automated distribution, education, and combined safety measures, although study quality and certainty vary. A long-term strategy must therefore address both individual practice and process design. This study summarizes major error mechanisms and prevention strategies, with particular emphasis on how pharmacists with clinical responsibilities can help support safer hospital medication management [6].

This article is a narrative review of published medication-safety literature and professional guidance relevant to hospital settings. The discussion draws on landmark safety of patient's publications, systematic reviews, Cochrane evidence, and guidance from organizations such as WHO and the American Society of Health-System Pharmacists (ASHP). The material is organized thematically around error types, contributing factors, prevention methods, and clinical pharmacist responsibilities. It is not presented as a systematic review: no exhaustive database search, formal screening process, pooled analysis, or PRISMA flow diagram is claimed. The evidence is interpreted descriptively, acknowledging that safety measures may have different effects across institutions and patient groups [7–8].

1.1 Definition and conceptual framework

A medication error is generally understood as a preventable event that may cause or lead to inappropriate medication use or patient harm while the medicine is under the control of a healthcare professional, patient, or consumer [2]. Errors can be intercepted before reaching the patient, reach the patient without causing harm, or result in an adverse outcome. Near misses are valuable safety signals because they reveal vulnerabilities without requiring injury to occur. Reason's systems model describes how hazards can pass through multiple imperfect defenses. In a hospital, these defenses may include standardized prescribing, pharmacist verification, medication storage controls, barcode scanning, independent checks for selected high-alert medicines, and monitoring after administration. An error is more likely to cause harm when several safeguards fail or are absent. This framework shifts the focus from blaming an individual to understanding why the process allowed the error [9].

1.2 Classification by stage of the medication management pathway

Medication-related errors may occur during prescribing, order communication or transcription, dispensing, preparation, administration, or monitoring. Prescribing errors include choosing an unsuitable medicine, incorrect dose, frequency, route, duration, or omission of relevant patient factors. Dispensing errors may involve selection of the wrong product or strength, labeling mistakes, or supply of an incorrect quantity. Administration errors include wrong patient, medicine, dose, route, time, or technique. Monitoring errors may occur when laboratory tests, clinical response, toxicity, or the need for dose adjustment are not assessed in a timely manner [2-4].

Table 1. Types of medication errors across the hospital medication-use process.

Stage	Representative error	Potential prevention measure
Prescribing	Wrong medicine, dose, route, frequency, duration; allergy or interaction overlooked	Structured orders, pharmacist review, CPOE/CDSS
Transcription/communication	Incomplete or ambiguous order; incorrect transfer of information	Standard terminology, read-back where appropriate, structured handover
Dispensing	Wrong product or strength; labeling or quantity error	Barcode verification, unit-dose systems, independent product check

Stage	Representative error	Potential prevention measure
Preparation	Incorrect dilution, reconstitution, calculation, or label	Standard concentrations, preparation protocols, pharmacy verification
Administration	Wrong patient, medicine, dose, route, time, or infusion rate; omitted dose	Patient identification, BCMA, eMAR, targeted double checks
Monitoring	Failure to assess response, toxicity, or required laboratory parameters	Monitoring plans, clinical review, pharmacist surveillance
Transitions of care	Unintended omission, duplication, or continuation at admission/discharge	Medication reconciliation and clear communication

1.3 Severity and potential harm

Severity ranges from circumstances with the capacity to cause an error to errors that reach a patient and cause temporary or permanent harm. Classification systems such as the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) index support consistent categorization. Severity assessment should consider the clinical context: an incorrect dose may have very different consequences in a healthy adult than in a neonate, a patient with renal impairment, or someone receiving a narrow-therapeutic-index medicine. Organizations should distinguish the number of reported errors from the number of harmful events, because increased reporting may reflect a stronger safety culture rather than deteriorating performance [10].

2. PRESCRIBING ERRORS

Prescribing errors are often associated with incomplete medication histories, incorrect clinical assumptions, unclear orders, inappropriate dose selection, contraindications, drug interactions, allergies, and failure to adjust treatment for renal or hepatic function. Errors may also occur when weight-based doses are calculated incorrectly or when units, decimal points, or infusion rates are misinterpreted. In busy clinical areas, verbal orders and illegible or abbreviated prescriptions may add ambiguity. Electronic prescribing may help lower some problems, but incorrect selections from menus, copied-forward orders, and defaults can create new error pathways [8].

2.1 Dispensing and preparation errors

Dispensing errors can occur when products with similar packaging or names are stored together, when the wrong strength is selected, or when labeling and patient-specific instructions are inaccurate. Preparation errors are particularly relevant to injectable medicines, concentrated electrolytes, chemotherapy, and infusion therapies. Incorrect dilution, calculation, reconstitution, or labeling may result in administration of an unintended dose. Standard concentrations, ready-to-administer products when appropriate, clear labels, and pharmacy-based verification may help lower variation.

2.2 Administration errors

Medication administration is a demanding task, often performed amid competing clinical priorities. Common problems include omitted or delayed doses, wrong-patient administration, incorrect route, wrong infusion rate, and failure to follow administration instructions. Interruptions during medication rounds, unavailable medicines, unclear orders, staffing constraints, and poor handover can contribute. The traditional ‘rights’ of medication administration right patient, medicine, dose, route, time, documentation, and other locally defined checks are useful reminders, but they cannot replace reliable process design and clinical assessment [11-12].

2.3 Monitoring and follow-up errors

Safe prescribing depends on ongoing assessment of effectiveness and toxicity. Monitoring errors include failure to study renal function for renally cleared drugs, omission of therapeutic drug monitoring when indicated, failure to follow potassium or glucose trends, and lack of response to signs of bleeding, sedation, or infection. Discharge can also create monitoring gaps when responsibility for follow-up tests or dose adjustments is unclear. Clear plans and communication between hospital teams and receiving clinicians are essential.

2.4 Errors involving transitions of care

Admission, transfer between units, and discharge are vulnerable points because medication lists may be incomplete, duplicated, or inconsistent. Patients may use prescription medicines, over-the-counter products, supplements, or intermittent therapies that are not documented in the inpatient record. A medicine may be unintentionally stopped, continued, or restarted. Medication reconciliation comparing the best possible medication history with current orders and resolving discrepancies helps reduce these risks [7,8].

3. HUMAN FACTORS

Human factors include fatigue, stress, cognitive overload, interruptions, reduced vigilance, unfamiliarity with a medicine, and reliance on memory. These conditions are common in hospitals operating around the clock. Individuals may make slips during routine tasks or mistakes when their knowledge, assumptions, or decision-making are inadequate. Training and competency assessment matter, but exhortations to 'be more careful' are insufficient when the working environment repeatedly promotes error [9, 11, 13].

3.1 Communication and teamwork

Medication plans are communicated across professions, shifts, departments, and care settings. Ambiguous verbal orders, incomplete handovers, inconsistent documentation, and failure to clarify uncertain prescriptions can cause discrepancies. Hierarchical culture may discourage junior staff from questioning an order. Structured handover methods, read-back of verbal orders when appropriate, standardized terminology, and psychological safety help team members raise concerns.

3.2 Workload, staffing, and workflow

High patient-to-staff ratios, frequent interruptions, rushed medication rounds, and inadequate pharmacy coverage may increase error likelihood. Crowded or poorly arranged workspaces, interruptions at preparation stations, and non-standard workflows make it harder to perform careful checks. The organization should evaluate the design of tasks and staffing patterns rather than treating error prevention as an individual responsibility alone.

3.3 Patient-related complexity

Older adults, children, critically ill patients, and people with multiple comorbidities may be especially vulnerable. Polypharmacy increases the possibility of interactions, duplicate therapy, and regimen complexity. Renal or hepatic impairment, altered body composition, swallowing difficulties, allergies, and rapidly changing clinical status require individualized medication decisions. Pediatric medication use often involves weight-based calculations and small dose volumes, increasing the need for standardized calculations and independent safeguards for selected high-risk orders.

3.4 Medication and system characteristics

Look-alike/sound-alike (LASA) medicines, similar packaging, multiple concentrations, high-alert drugs, and complex administration instructions create opportunities for selection or dosing errors.

High-alert medicines such as insulin, anticoagulants, opioids, concentrated electrolytes, and certain sedatives can cause substantial harm when used incorrectly. Information systems can also contribute through alert fatigue, confusing interfaces, poor interoperability, or inappropriate defaults. ASHP guidance recommends organizational safety planning, interprofessional review, and ongoing evaluation of medication management pathways [13].

Table 2. Contributing factors and practical system responses.

Contributing factor	How it may increase risk	Practical response
Fatigue and work demands	Reduced attention and increased slips	Workload review, adequate staffing, fatigue-aware scheduling
Interruptions	Loss of task focus during preparation or administration	Protected medication preparation zones and interruption management
Communication gaps	Unclear orders or incomplete handovers	Structured handover, standardized order formats, escalation pathways
Polypharmacy and complex patients	More interactions, discrepancies, and monitoring needs	Medication review, reconciliation, patient-specific dose adjustment
LASA medicines and high-alert drugs	Selection or dose errors may cause serious harm	Segregated storage, differentiation, protocols, risk-based checks
Technology design issues	Alert fatigue, wrong defaults, workarounds	User-centered design, alert optimization, audits and feedback
Punitive culture	Under-reporting and limited organizational learning	Just culture, confidential reporting, feedback and improvement

4. MEDICATION RECONCILIATION

Medication reconciliation is best performed at admission, transfer, and discharge, with priority given to patients at increased risk of discrepancies. A best possible medication history includes prescribed medicines, non-prescription products, supplements, dose, route, frequency, adherence, and relevant allergies or previous reactions. Sources may include the patient or caregiver, medication containers, community pharmacy records, prior clinical records, and prescribers. The process is not simply list-copying: discrepancies must be clarified and intentional changes documented. Evidence suggests reconciliation may help lower medication-related errors and may reduce adverse drug events, although certainty varies by comparison and outcome [7,13].

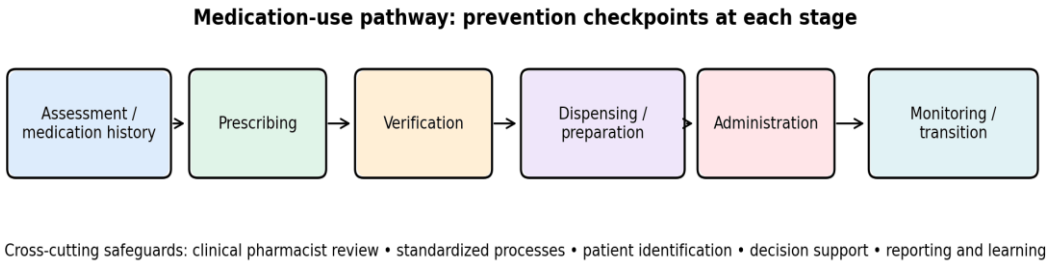

Figure 1. Medication-use pathway and points for error prevention.

4.1 Computerized provider order entry and clinical decision support

Computerized provider order entry (CPOE) replaces handwritten orders with structured electronic prescriptions. It may strengthen legibility, support standardized order sets, and enable checks for allergies, interactions, dose ranges, duplication, and patient-specific factors. Clinical decision support systems (CDSS)

can provide targeted alerts or recommendations. Their benefit depends on usability, data quality, and alert relevance. Excessive low-value alerts can produce alert fatigue, causing clinicians to override important warnings. Hospitals should prioritize high-severity, actionable alerts, monitor override patterns, and periodically review system performance [6–8].

4.2 Barcode-assisted medication administration

Barcode-assisted medication administration (BCMA) links patient identification with the medicine barcode and electronic medication administration record. Scanning at the bedside can help detect wrong-patient and wrong-drug errors and support documentation. Implementation depends on reliable wristbands, readable barcodes, device availability, connectivity, and workflow integration. Workarounds such as scanning away from the bedside or using surrogate barcodes can undermine the intended safeguards. BCMA should complement, not replace, clinical assessment and verification.

4.3 Standardization and safer medication storage

Standardized concentrations, dosing protocols, order sets, labeling, and storage arrangements reduce variation. LASA medicines are best separated where feasible, clearly differentiated, and reviewed using risk-based measures such as selective Tall Man lettering. High-alert medications require explicit safeguards: restricted access to concentrated electrolytes, standardized insulin protocols, clear anticoagulant monitoring, and carefully designed infusion processes. Independent double checks may be appropriate for selected high-risk steps, but indiscriminate double checking can become ritualistic and should not substitute for stronger system controls.

4.4 Automated dispensing and distribution

Automated dispensing cabinets, unit-dose distribution, and pharmacy automation may improve access control, inventory accuracy, and product selection. These systems need correct configuration, replenishment checks, segregation of high-risk items, and clear procedures for overrides and urgent access. Automation may shift rather than eliminate error risk; therefore, implementation should include process mapping, staff training, and routine audits.

4.5 Education, competency, and safety culture

Regular education should address prescribing principles, dose calculations, high-alert medications, LASA products, medication reconciliation, administration technique, and reporting. Training is most useful when linked to real workflows and followed by competency assessment. A just culture distinguishes human error, at-risk behavior, and reckless conduct, while supporting fair accountability. Staff are best able to report errors and close calls without fear of automatic punishment. Reporting systems should provide feedback and lead to visible improvements rather than merely accumulating records [13-14].

4.6 Patient and caregiver engagement

Patients can contribute by sharing an accurate medication history, describing allergies, asking questions, and confirming the purpose and instructions of medicines. Counseling should use plain language and, where necessary, interpreters or teach-back. Patients are best encouraged to alert staff when a medicine, dose, or timing appears unfamiliar. Engagement is a complementary defense; responsibility for safe medication systems remains with the healthcare organization and professionals.

5. MEDICATION HISTORY AND RECONCILIATION

Pharmacists with clinical responsibilities are trained to obtain and evaluate medication histories, identify discrepancies, and assess whether inpatient orders reflect the patient's intended therapy. At admission, they can clarify prior treatment, allergies, adherence, and medication-related problems. During transfer and discharge, they can verify changes, identify omissions or duplications, and communicate an accurate medication list. Pharmacist-led reconciliation has been associated with

reductions in prescribing errors in intervention study's, although effects on broader outcomes may differ [6–8].

5.1 Prescription review and clinical verification

Pharmacists review medication orders for indication, dose, route, frequency, duration, contraindications, interactions, duplication, allergy risks, and suitability for the patient's organ function and clinical status. They can detect inappropriate dose intervals, excessive duration, unnecessary therapy, and missing prophylaxis or monitoring. Recommendations are best communicated clearly and documented, with urgent concerns escalated promptly. Collaborative practice arrangements can support timely adjustment when authorized by institutional policy and applicable law.

5.2 Participation in ward rounds and interprofessional teams

Participation in ward rounds enables pharmacists to integrate medication expertise with clinical decisions. They can advise on antimicrobial selection and de-escalation, renal dose adjustment, therapeutic drug monitoring, analgesia, anticoagulation, fluid and electrolyte management, and transitions of care. Direct communication with prescribers and nurses can resolve issues before an order is administered. Pharmacist partnership and multicomponent safety measures have been identified among strategies associated with reduced prescribing errors [6, 15].

5.3 High-alert medication management

Pharmacists with clinical responsibilities can help develop institutional protocols for high-alert medicines, study concentrations and infusion rates, support smart-pump libraries, and assess the appropriateness of monitoring. In insulin therapy, for example, they may verify regimen selection, review glucose trends, identify duplicate orders, and ensure that hypoglycemia management is available. For anticoagulants, they may assess indication, dose, renal function, interactions, and monitoring plans. These activities require collaboration with nursing and medical teams.

5.4 Patient counseling and discharge support

Pharmacist counseling at discharge can explain medicine changes, purpose, dose, timing, duration, important adverse effects, and what to do when a dose is missed. Patients with complex regimens may benefit from a written schedule or adherence aid. Counseling should verify understanding rather than assume that receipt of information equals comprehension. When possible, pharmacists should communicate clinically important changes and monitoring needs to community clinicians or pharmacies.

5.5 Medication safety surveillance and reporting

Pharmacists can help support medication incident reporting, study error patterns, identify recurring hazards, and participate in root-cause analysis or failure mode and effects analysis. They may support safe medication use committees, formulary decisions, LASA assessments, protocol development, and audit-and-feedback activities. Systematic review evidence emphasizes pharmacist-centered prevention and education as important strategies, while also recognizing that safe medication use depends on the broader healthcare team [15].

Table 3. Clinical pharmacist activities and medication-safety outcomes.

Clinical pharmacist activity	Examples of contribution	Suggested indicator
Medication reconciliation	Identify and resolve discrepancies at admission, transfer, and discharge	Discrepancies resolved per eligible patient
Prescription review	Detect unsuitable dose, interactions, duplication, contraindications	Clinically significant prescribing issues intercepted

Clinical pharmacist activity	Examples of contribution	Suggested indicator
Ward-round participation	Provide patient-specific medication recommendations	Recommendation acceptance and timeliness
High-alert medication review	Check protocols, concentrations, dose, monitoring	Compliance with high-alert medication safeguards
Patient counseling	Explain medicine changes and essential instructions	Teach-back completion or documented understanding
Incident analysis	Review reports and support root-cause analysis	Action plans completed and recurrence trends
Quality improvement	Audit processes and give feedback to teams	Change in error rates or preventable harm indicators

5.6 Measuring the contribution of clinical pharmacy services

Pharmacy services are best evaluated using meaningful outcomes rather than counting safety measures alone. Potential indicators include clinically significant prescribing errors intercepted, medication discrepancies resolved, acceptance of pharmacist recommendations, preventable adverse drug events, high-alert medication compliance, and timeliness of reconciliation. Measures are best adjusted for patient volume and case mix when appropriate. Balancing measures, such as time to first dose or unintended treatment delays, help ensure that safety initiatives do not inadvertently disrupt care.

6. INTENSIVE CARE UNITS

ICUs involve rapid treatment changes, multiple infusions, organ dysfunction, and frequent use of high-alert medicines. Safety measures include standardized infusion concentrations, smart-pump libraries, pharmacist review, clear line labeling, careful dose adjustment, and structured handovers. Medication study is best repeated as physiology and organ support change [8,11].

6.1 Emergency departments

Emergency care is characterized by time pressure, incomplete histories, transitions into inpatient care, and urgent medication administration. Rapid access to reliable medication histories, clear verbal-order procedures, weight-based dosing aids, and reconciliation at admission may help lower risk. Pharmacists can help clarify histories and study high-risk orders where service models permit.

6.2 Pediatric and neonatal units

Pediatric safe medication use is complicated by weight-based dosing, small volumes, age-dependent pharmacokinetics, and the use of concentrations that may differ across settings. Use of kilograms rather than pounds, standardized concentrations, dose-range checking, validated calculation tools, and independent verification of selected high-risk calculations are important safeguards. Caregivers may also provide key information about home medications and previous reactions [8].

6.3 Surgical and perioperative settings

Perioperative care may involve medication reconciliation before surgery, anesthetic medicines, prophylactic antibiotics, analgesics, anticoagulants, and postoperative transitions. Clear documentation of medicines held or resumed, allergy assessment, and handover of administered drugs is important. Standardized protocols may help lower ambiguity during high-pressure periods. An effective reporting system captures errors and close calls from all medication-use stages. Reports should include enough information to understand the event, contributing conditions, and potential consequences, while protecting confidentiality in accordance with institutional policy. Voluntary

reporting is useful for identifying hazards but cannot estimate the true incidence of errors by itself because reporting is influenced by awareness, work demands, and safety culture [16].

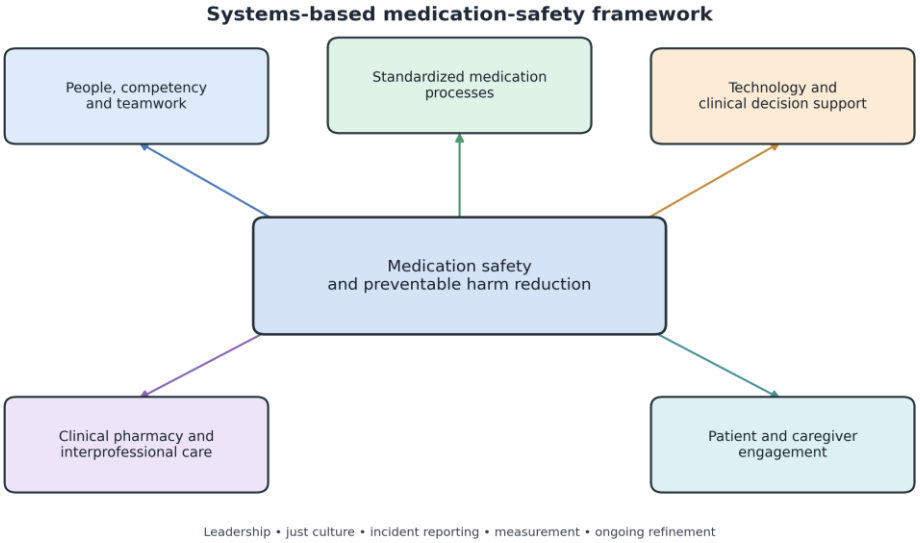

Figure 2. A systems-based framework for hospital medication-error prevention.

Root-cause analysis can be used after serious events to identify system contributors, while prospective methods such as failure mode and effects analysis can examine vulnerable processes before harm occurs. Findings should result in action plans with accountable owners, timelines, and follow-up measures. Examples include changing storage, revising order sets, standardizing concentrations, improving staffing or workflow, and redesigning alerts. Education alone is rarely an adequate response when an organizational vulnerability remains. Quality improvement depends on continuous feedback. Hospitals can monitor error trends, severity, medication classes involved, locations, and stages of the process. Data are best interpreted alongside patient volume and reporting culture. An increase in near-miss reports after introducing a non-punitive reporting program may represent improved detection. Safety dashboards should avoid simplistic comparisons that encourage under-reporting or concealment [9, 13, 16].

7. TECHNOLOGY ADOPTION AND INTEROPERABILITY

Electronic medication systems can be expensive and require infrastructure, staff training, maintenance, and interoperability across departments. Poorly integrated systems may create duplicate documentation or incomplete medication records. Implementation should include end-user involvement, workflow testing, staged deployment, and post-implementation surveillance. Downtime procedures must be designed and rehearsed.

7.1 Alert fatigue and automation bias

Clinicians may become desensitized to repeated alerts or may over-trust computerized recommendations. Alert design is best clinically prioritized and transparent, with clear rationale and actionable choices. Automation should support not replace professional judgment. Regular evaluation of overrides, false positives, and missed warnings is essential.

7.2 Resource limitations

Some hospitals, particularly those with constrained resources, may not have comprehensive electronic systems, round-the-clock clinical pharmacy services, or automated dispensing technology. Foundational safety measures can still be implemented: standardized medication charts, reliable patient identification, clear labeling, safer storage, structured reconciliation, focused training, and accessible incident reporting. Resource allocation should prioritize risks with the greatest potential for patient harm.

7.3 Artificial intelligence and data-driven surveillance

Emerging tools may help identify unusual doses, interactions, duplicate therapy, or patterns in incident reports. Machine-learning systems could support risk prioritization and surveillance, but they require representative data, validation, explainability, governance, and monitoring for bias. False alerts and inappropriate recommendations may introduce additional hazards. Pharmacists with clinical responsibilities can contribute domain expertise to model validation and interpretation, ensuring that recommendations remain clinically meaningful.

7.4 Future research priorities

Future evaluations should use stronger comparative designs, consistent definitions, and clinically meaningful outcomes. Research should distinguish errors intercepted from errors causing harm, examine implementation fidelity, and evaluate safety measures in diverse hospital contexts. Studies should assess how pharmacist staffing models, technology combinations, patient engagement, and organizational culture influence outcomes. Economic evaluations may help hospitals identify long-term investments in safe medication use [6,7]. Medication-related errors are multifactorial events arising from the interaction of clinical complexity, human factors, communication, technology, and organizational design. The literature discussed here favors the use of several complementary safety measures rather than reliance on a single safeguard. Pharmacist-led reconciliation and clinical collaboration may strengthen the quality of prescribing, while CPOE, CDSS, barcode systems, and automated distribution may reduce selected error types. However, the certainty and magnitude of benefit vary across safety measures and outcomes, and implementation quality strongly influences results [6-8,14,17].

The clinical pharmacist has a distinctive role because medication expertise is applied across the entire process, from obtaining medication histories to reviewing prescriptions, monitoring treatment, and supporting discharge. Pharmacists can identify errors that may be difficult to detect through routine checks alone, particularly when patient-specific factors such as organ function, comorbidities, or interacting therapies are considered. Their impact is greatest when they are integrated into interprofessional workflows and can communicate recommendations directly to prescribers and nurses [15].

Nevertheless, the pharmacist should not be viewed as the sole safety barrier. Excessive dependence on pharmacy verification can leave other process weaknesses unresolved and may create bottlenecks. Hospitals should distribute responsibility appropriately among prescribing, nursing, pharmacy, information technology, leadership, and patients. A just culture, adequate staffing, standardized processes, and learning from close calls are necessary to sustain improvement. Local assessment is also important because the most relevant safety measures depend on hospital size, patient population, technology, and available resources. Medication safety is best judged not only by fewer reported errors, but by reduction in preventable harm, improved reliability, and better continuity of care. Monitoring systems should combine incident reports with structured chart review, trigger tools, audits, and patient feedback where feasible. The goal is to build a resilient medication-use system in which errors are less likely, are detected early, and are mitigated before they cause injury [5,16].

8.CONCLUSION

Medication-related errors in hospitals can occur at every stage of the medication management pathway and are influenced by clinical complexity, work demands, breakdowns in communication, human factors, and process design. Prevention depends on coordinated measures that include medication reconciliation, standardized processes, electronic prescribing and decision support, barcode-assisted administration, targeted safeguards for high-alert medicines, education, patient engagement, and a non-punitive reporting culture. Pharmacists with clinical responsibilities play an important role through medication history taking, prescription review, ward-round participation, monitoring, counseling, incident analysis, and service improvement. Their contribution is strongest when embedded within an interprofessional safety of patient's program. Hospitals should continuously evaluate safety measures using clinically meaningful measures and adapt measures to local needs. A systems-based and collaborative strategy offers the most practical path toward reducing avoidable injury associated with medicines.

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