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# MEDICATION SAFETY IN NURSING PRACTICE: STRATEGIES FOR PREVENTING MEDICATION ERRORS AND IMPROVING PATIENT OUTCOMES

**Dr. Niti Mittal[1], Dr. Ajita Kapur[2]**

[1]Department of Pharmacology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India, Email: drniti.mittal@gmail.com / drnitimittal@uhsr.ac.in

[2]Department of Pharmacology, ABVIMS & Dr. RML Hospital, New Delhi, India, Email: drajitakapur.rml@gmail.com

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**ABSTRACT-**

Medication safety is a vital aspect of nursing care and a key factor in patient outcomes in all health-related environments or areas. Nurses are at a critical point to prevent medication-related harm because they are involved with the medication in multiple ways, including verification, preparation, administration, monitoring, reconciliation, and patient education. The major categories and factors related to medication errors, nurse's role in safe medication use and evidence-based interventions to prevent adverse events are reviewed. Medication errors can be attributed to situation-related factors, such as lack of knowledge, fatigue, stress, limited experience and organizational factors, such as insufficient staffing, workload, interruptions, communication problems and medication systems that are poorly designed. Preventive approaches include standardized administration procedures, medication reconciliation, competency-based education, simulation training, patient engagement, interprofessional collaboration, and supportive safety cultures. When effectively integrated into clinical workflows, technology-enabled systems such as barcode medication administration, electronic medication records, clinical decision support, automated dispensing systems, and smart infusion pumps can further bolster medication safety. Special attention needs to be paid to older adults, pediatric patients, critically ill patients and patients undergoing transitions of care. Medication safety enhancement demands a focused nursing surveillance, improved communication, human-friendly technology, ongoing professional learning and organizational learning. Improved strengthening of these elements will decrease medication errors, avoidable harm, and increase patient care safety, continuity, and quality.

**Keywords:** Medication safety; Medication errors; Nursing practice; Patient safety; Medication administration; Patient outcomes

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## 1. Introduction

Medication safety is critical to patient safety and is a key element of healthcare quality. Medicines are one of the most common interventions in health care, but they can also have significant harms when there are errors in the process of prescribing, dispensing, preparation, giving, monitoring or transitioning care. Medication-related harm therefore represents an important and largely preventable challenge for health systems worldwide. Medication safety has been identified as a global priority and the World Health Organization (WHO) has urged coordinated action to decrease medication related avoidable harm through better systems, safer clinical practices, staff training and development, and increased patient engagement (World Health Organization [WHO], 2021). Although there have been improvements in health care delivery, medication errors remain a frequent problem in both hospital, primary and long-term care and community settings, leading to avoidable morbidity, longer hospital stays, higher health care costs and in extreme cases death (WHO, 2023a; Hodkinson et al., 2020).

The burden of medication-related harm is a complex phenomenon in which human, organizational, and system-related factors are involved in the medication-use process. Common sources of error include incorrect doses, incorrect medicines, giving the wrong medicine to the wrong patient, giving the medicine at the wrong time or place, failure to take the medicine, poor monitoring, and poor communication and documentation. The issue is especially relevant in cases of high alert medicines, complicated treatment plans, intravenous treatments, and patients with a number of clinical conditions. In situations of high risk, extra precautions are needed, as the potential impact of one error could be clinically relevant (WHO, 2019a). The focus on individual responsibility has thus been replaced by a more systems-based approach to medication safety by accounting for factors that affect the safe use of medicines such as workload, staffing, work design, communication, technology, organisational culture, and interprofessional coordination.

Nurses are a key role in this medication safety system, since they are directly involved in preparing and giving medicines and are often the final clinical check before medicines are given to the patient. Their role is not only to administer prescribed medications, but also to verify medication orders, conduct medication and allergy checks, evaluate any adverse drug reactions, look for discrepancies, document medication administration, and educate patients and families. The likelihood of MAE can then be affected by nursing knowledge, clinical experience, workload, working conditions, and following safe medication practices (Kerari & Innab, 2021). The intimate and regular interaction with patients also allows the nurse to detect new medication related problems and prompt communication with physicians, pharmacists, and other healthcare practitioners.

The management of medicines is becoming more complex with older populations, with the rise of multimorbidity and polypharmacy. Use of more than one medicine concurrently is associated with greater risk of drug interactions, inappropriate prescribing, therapeutic duplication, adverse effects

and therapeutic adherence issues, especially among older adults (WHO, 2019b). Meanwhile, medication safety opportunities have been created through the use of technology, including electronic medication administration records, computerized order entry, barcode medication administration, automated dispensing systems, and smart infusion pumps. But without technology, risk cannot be eliminated as poorly designed systems, alert fatigue, workarounds and insufficient integration into clinical workflows can create new avenues for error. Therefore, evidence-based approaches should be adopted to ensure medication safety, involving nursing skills, standardisation, technology and equipment, interprofessional cooperation, organisational learning and patient engagement (WHO, 2024).

Against this background, this review aims to critically examine medication safety in nursing practice and the strategies used to prevent medication errors and improve patient outcomes. Specifically, the review has three objectives:

(1) to examine the major types, contributing factors, and patient-safety consequences of medication errors relevant to nursing practice

(2) to evaluate evidence-based nursing, organizational, technological, and interprofessional strategies for preventing medication-related harm

(3) to identify implications for patient outcomes, nursing practice, and future approaches to strengthening medication safety across diverse healthcare settings.

## 2. Medication Errors and Their Impact on Patient Safety

Common areas of concern for medication error as it relates to nursing practice are during preparation, administration, documentation, and after administration monitoring. These include errors in prescribing the wrong drug, giving the wrong dose, the wrong patient, wrong route, documentation errors, failure to give the medication on time, omitting the medication, and not recognising or responding to adverse effects. Nurses are frequently the last to cross-check before the medication is given to the patient, so a mistake when administering a medication may have an immediate impact on the patient (Fathizadeh et al., 2024; Wudu et al., 2025). In spite of safety measures in place, prospective evidence demonstrates that administration errors still can happen, indicating the need for accurate bedside checking, documentation, dose calculation and vigilance (Tesar et al., 2025).

Table 1 presents the major categories of medication errors encountered in nursing practice and their potential consequences for patient safety.

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**Table 1. Major Medication Errors Relevant to Nursing Practice and Their Patient-Safety Consequences**

| Medication error | Nursing-related example | Potential consequence |
|---|---|---|
| Wrong medication | Incorrect drug selected or administered | Adverse drug event, treatment failure |
| Wrong dose | Incorrect calculation or dose preparation | Toxicity or inadequate treatment |
| Wrong patient | Failure of identity verification | Harm to unintended patient |
| Wrong route | Oral drug given intravenously or vice versa | Severe adverse effects |
| Wrong timing | Medication administered too early or late | Reduced therapeutic effectiveness |
| Omission | Prescribed dose not administered | Disease progression or treatment failure |
| Documentation error | Administration not recorded accurately | Duplicate or missed doses |
| Monitoring error | Failure to recognize adverse response | Delayed intervention and preventable harm |

Nurses' capacity to detect discrepancies prior to administration, and the capacity to recognise adverse responses following administration, are closely related to the causes of medication related harm. Errors may result in further treatment, extended hospitalizations, more complications and, in extreme cases, deaths. They can also decrease the patients' trust in the security of nursing services. Multiple hospital systems have reported that medication administration errors often stem from issues with processes, communication, and monitoring, all aspects of which are directly

related to nursing care (Govil et al., 2025; Tobaiqy & MacLure, 2024). In addition to the risk of errors occurring during medication rounds and other nursing activities, workload, interruptions and stressful clinical setting also contribute to this risk (Mohammed et al., 2022).

During high-risk situations, it is very important to be vigilant as a nurse. Polypharmacy makes medication regimens more complex, increases the risk of medication duplication and medication interactions, and with intravenous and/or high alert medications, the dosage, administration, and monitoring are more critical. Accurate nursing documentation, medication reconciliation and handover are also critical to transitions of care. After discharge, discrepancies in medications can include missing medications, inconsistent doses, continuation of medications that may not be appropriate, or lack of medication follow-up (Alqenae et al., 2020). Enhancing nursing verification, documentation, monitoring and communication is thus a key element in minimizing preventable medication-related harm.

## 3. Nursing Roles and Responsibilities in Medication Safety

Nurses ensure medication safety throughout the medication use pathway, starting from assessment and verification, medication administration, monitoring, medication education and medication transitions of care. A medication history is crucial, because it helps to determine the correct treatment based on the patient's history of medications, any adverse response, allergy or contraindication. Nurses also check medication orders to ensure accuracy with the patient's identity, prescribed dose, route of medication, timing of medication administration, and clinical information which is important in detecting discrepancies prior to causing harm. Their duties in pharmaceutical care are thus far more complex than just administering tasks and involve clinical judgment, communication, monitoring, and working with other professionals (De Baetselier et al., 2022; Dilles et al., 2021).

Consistent, adherence to medication procedures is essential to safe preparation and administration, especially with high alert drugs, complicated medications, and IV medicines. When the risk of medication is high, other safeguards such as dose calculation, route confirmation and independent double checking can be used. But medication safety in practice also relies on the adaptiveness of the nurse in the face of different clinical circumstances while not neglecting necessary safety measures. There is evidence of resilience in the administration of medicines to indicate that nurses often have competing demands, interruptions and flow pressures as they try to keep medicines going safely (Kellett et al., 2024). This serves to reiterate the need to blend with procedure with clinical sense and awareness.

Another important aspect of nursing care after administration is the monitoring. The nurse evaluates therapeutic response, monitors for side effects of the drug, identifies signs of toxicity or failure to respond and refers them up should status of the patient change. The functions are

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especially relevant since they can be the first indications of a medication problem may be seen at the bedside. The interprofessional pharmaceutical care offers support to this role, because nurses are able to communicate with pharmacists and doctors about issues related to medicines, and to take part in shared decision making with other health professionals using medicines (De Baetselier et al., 2020).

Medication reconciliation is particularly critical when someone is admitted, transferred, or discharged as there may be gaps or discrepancies in medication information. Nursing engagement in accurate medication lists (AML) verification and communication during transitions of care (ToC) (Mardani et al., 2020; Remane et al., 2024). Discharge education is another factor that contributes to safer medication practices after discharge as nurses educate patients and families on medication purpose, dosage, potential adverse effects, adherence, and red flag symptoms. Nurse-led interventions have proven to be a valuable tool for enhancing adherence to medications in chronic diseases, underscoring the significance of education and follow-up in medication safety (Berardinelli et al., 2024).

Figure 1 presents the major nursing medication-safety checkpoints across the medication-use pathway, from initial medication history and order verification to administration, monitoring, reconciliation, and patient education.

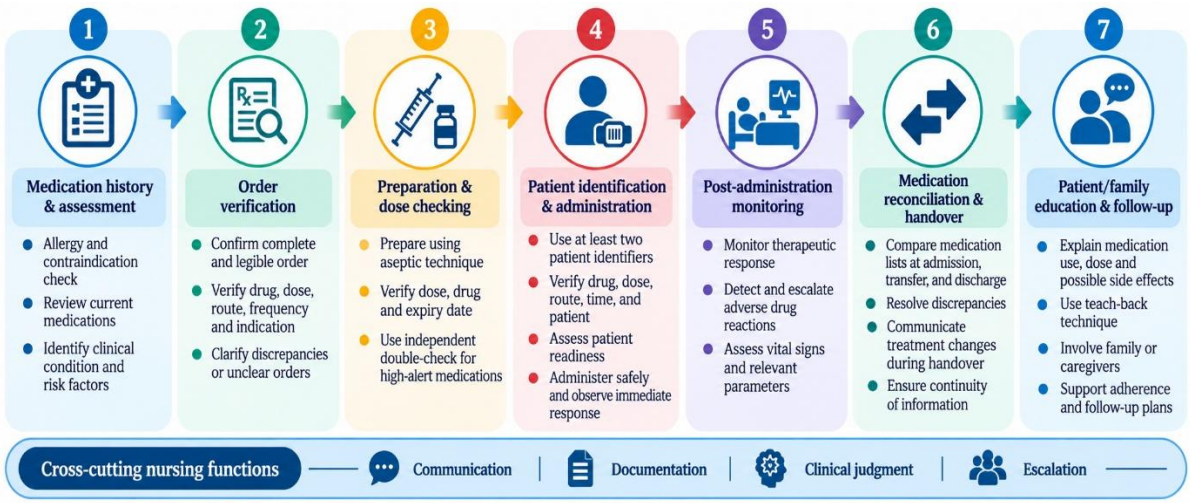



**Figure 1. Nursing Medication-Safety Checkpoints Across the Medication-Use Pathway**

## 4. Factors Contributing to Medication Errors in Nursing Practice

In nursing practice, medication error seldom occurs due to one main cause. They usually occur when there are gaps in communication, weaknesses in the medication system, individual capability, and working conditions. This is crucial as these factors can influence the effectiveness of

prevention strategies, which are more likely to be effective if they target both frontline practice and the context in which nurses are working (Coelho et al., 2024).

### 4.1 Individual and Professional Factors

The lack of knowledge, lack of clinical experience, fatigue, stress, and cognitive overload can affect medication-related decisions. New nurses are at risk of making medication errors when handling unfamiliar medications, complicated dosages, and/or changing clinical circumstances, particularly when there are limited resources to provide supervision (Webb et al., 2025). Omissions, incorrect calculations or failure to follow verification procedures are also possible due to fatigue and demands from the shifts. In addition, shift work and stressful clinical situations have been associated with the incidence of medication errors in the hospital nursing practice (Gilavand et al., 2023). These risks highlight the importance of continuing education, competency assessment, and adequate support for less experienced nurses.

### 4.2 Organizational and Work Environment Factors

Medication administration sometimes takes place in the context of competing demands. Poor nurse to patient ratios, staffing levels, time pressures, frequent interruptions and workflow design can impact concentration during preparation and administration. Nurses can find themselves moving around constantly between patient care, documentation, communication, and medication-related activities, which can lead to problems with checking or shortcuts in procedures. Workload and organisational factors might significantly impact on the reliability of medication administration, as perceived by hospital nurses (Blignaut et al., 2022). A safer medication system, then, necessitates workflow designs that will minimize the interruption of high-risk tasks.

### 4.3 Communication and System Factors

Medication discrepancies can be caused by incomplete prescriptions, poor handovers, poor documentation and poor standardization, which could be identified by the nurse before giving the medicine. System design can also contribute directly to error. Look-alike and sound-alike medicines are a specific concern as it is possible for these to be confused in medicine selection, packaging, labeling, and/or storage space (Ryan et al., 2024). Automated dispensing systems do not eliminate this risk unless look-alike and sound-alike medicines are clearly differentiated and stored safely (Ruutiainen et al., 2021). These issues have also been raised in India, where look-alike and sound-alike medicines continue to be a significant matter to address regarding medication safety (Neelakantan et al., 2024). So, for effective prevention, there needs to be a greater emphasis on communication, consistent documentation, safer storage and system controls as well as individual nursing vigilance.

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Table 2 summarizes key individual, organizational, communication, and system-related contributors to medication errors together with corresponding nursing safety measures.

**Table 2. Factors Contributing to Medication Errors and Corresponding Nursing Safety Measures**

| Contributing factor | Examples | Nursing safety measure |
|---|---|---|
| Knowledge and experience | Knowledge gaps, unfamiliar medications | Continuing education and competency assessment |
| Fatigue and cognitive load | Long shifts, stress, multitasking | Workload management and protected medication tasks |
| Staffing and workload | High patient-to-nurse ratios | Adequate staffing and task prioritization |
| Interruptions | Questions and competing activities during preparation | Interruption-reduction strategies |
| Communication failure | Incomplete orders and poor handovers | Structured communication and clarification |
| Documentation problems | Missing or inconsistent medication records | Accurate real-time documentation |
| Medication design | Look-alike or sound-alike medicines | Clear labeling, separation, and verification |
| Workflow weaknesses | Complex or inconsistent procedures | Standardized medication processes |

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## 5. Evidence-Based Strategies for Preventing Medication Errors

To minimize medication errors, effective strategies are needed that improve clinical processes, nursing skills, medication review, and patient involvement. Interventions that decrease the amount of memorizing required, and establish safe "bubbles" around high-risk periods of medication use are most useful.

### 5.1 Standardized Medication Administration Practices

Use of standardized protocols, checklists and well-defined operating procedures can minimize variation in preparation and administration of medications. Medications that are considered high alert drugs are especially critical and if a mistake occurs could cause harm. The addition of independent verification can give further protection but how effective it will be in practice will be dependent on how regularly and effectively it is carried out. Double checking is needed when workflow demands are high, as evidenced here, suggesting that processes for checking may be adapted or omitted when the workload is regular and not excessive (van Stralen et al., 2024). Checklists and structured reporting systems can further support safer practice by reinforcing critical steps and enabling recurrent risks to be identified (Chance et al., 2024).

### 5.2 Medication Reconciliation and Review

Medication reconciliation is a critical component to admission, transfer, and discharge when there may be more opportunities for discrepancies to arise. The medication comparison can help detect missing medications, duplicate drugs, dose variations, and unintended drug changes. Systematic reviews suggest that interventions for the reconciliation of medications increase medication accuracy but the impact of such interventions on other clinical outcomes is not consistent across settings (Anderson et al., 2019). The multidisciplinary approach, with the involvement of the nurse, the pharmacist and the prescribing physician, can reinforce this process, in which the nurse is present at the bedside, the pharmacist has the pharmacological knowledge and the prescribing physician has the prescribing power.

### 5.3 Education, Competency, and Workflow Improvement

Continuing education in dosage calculations, high-risk medications, intravenous therapy and changing medication technologies is required to remain competent. Medication administration and dosage-calculation abilities have demonstrated benefits of simulation training and the opportunity to practice error recognition in simulated environments (Mahou et al., 2024; Shor et al., 2024). Nurses can also experience interruptions and competing demands during simulation, and develop strategies to help focus them during medication preparation (Davidson et al., 2022). Medications rounds, interruptions and improved workflow design at the organizational level can also help reduce cognitive overload when medication is administered.

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### 5.4 Patient Engagement in Medication Safety

When patients and families are involved with the use of medication, they can offer an extra layer of protection. Patients can be encouraged to confirm medicines, keep current medicines lists, be aware of indications and dosages, and be aware of adverse effects, which can help to improve detection of discrepancies. Teach-back can be used to verify understanding, especially post treatment change or discharge. Pa Patient-Directed Medication Monitoring and Self-Management (PDMSM) is a value-added intervention for older adults with chronic diseases (Xu et al., 2024). Adherence support is also key, as these medications require ongoing adherence and consistent communication, follow-up, and interventions that address the individual barriers (Anderson et al., 2020). Combined, these strategies contribute to medication safety being a shared responsibility, with a clear process for standardized medication practice, competent practice, and multidisciplinary review, and informed patient involvement.

Table 3 presents the principal evidence-based strategies used to strengthen medication safety and reduce preventable medication errors in nursing practice.

**Table 3. Evidence-Based Strategies for Preventing Medication Errors in Nursing Practice**

| Strategy | Core approach | Expected safety benefit |
|---|---|---|
| Standardized administration | Protocols, checklists, standard procedures | Reduces variation and omitted safety checks |
| Independent verification | Double-checking high-risk medications | Detects dose and selection errors |
| Medication reconciliation | Verification at admission, transfer, and discharge | Reduces unintended discrepancies |
| Nursing education | Continuing education and competency training | Improves knowledge and calculation accuracy |
| Simulation training | Practice of complex and high-risk scenarios | Strengthens clinical judgment and error recognition |

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| | | |
|---|---|---|
| Workflow improvement | Protected medication rounds, fewer interruptions | Reduces distraction-related errors |
| Patient engagement | Teach-back and medication verification | Improves understanding and discrepancy detection |
| Multidisciplinary review | Nurse–pharmacist–physician collaboration | Improves medication appropriateness and coordination |

Figure 2 presents a multilevel framework showing how individual, work-environment, communication, and system factors contribute to medication-error risk, while preventive nursing and organizational strategies support safer medication use, reduced medication-related harm, and improved patient outcomes.

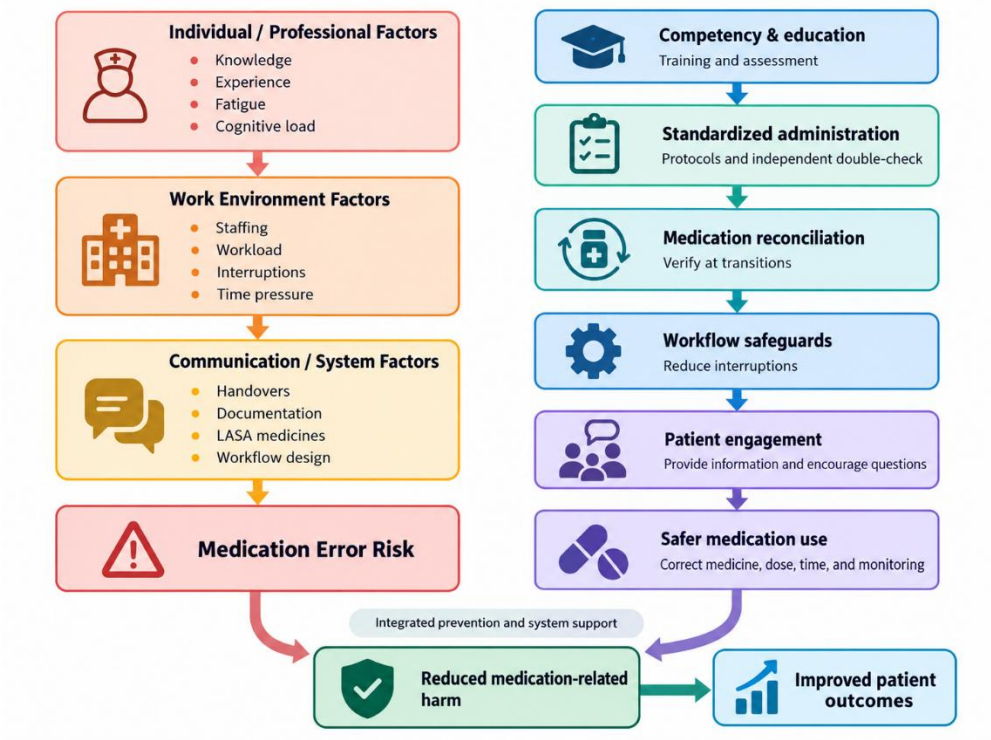



**Figure 2. Multilevel Framework Linking Medication-Error Risk Factors With Preventive Nursing and System-Level Strategies**

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## 6. Technology-Enabled Approaches to Medication Safety

The use of technology has continued to increase as part of medication management, offering further protection at the prescribing, dispensing, administration and monitoring phases. Digital systems, when designed and implemented correctly, can help decrease transcription errors, medication traceability and timely verification. The effectiveness of these, however, relies on integration between technology and the practice of nursing.

### 6.1 Digital Medication Systems

The most common digital methods include electronic medication administration records, barcode medication administration, computerized provider order entry and clinical decision support systems. Bedside verification systems can be improved through barcode technology which allows for the patient, prescription, and administration information to be compared prior to administering treatment. The effect is dependent on usability, how well it fits into the workflow and staff uptake as poorly aligned systems can increase the likelihood of bypasses or workarounds (Williams et al., 2021). Closed-loop medication systems also have the ability to integrate prescribing, verifying, dispensing, administration and documentation, further decreasing fragmentation along the medication-use pathway (Shermock et al., 2023). Studies also suggest that using computerised order entry systems in conjunction with clinical decision support systems can help minimise errors of dose, especially when prescribing for complex groups like paediatric patients (Ruutiainen et al., 2024). Laboratory-embedded decision support can also be used to support the identification of inappropriate dosing and possible adverse drug events by leveraging relevant clinical information in the prescribing and monitoring process (Whitehead et al., 2019).

### 6.2 Smart Medication Technologies

Smart infusion pumps and automated dispensing systems provide additional control over medication preparation and administration. Smart pumps have dose-error reduction software and preprogrammed libraries of drugs to minimize unsafe infusion parameters. These systems have been recommended to improve infusion safety, but their effectiveness relies on proper programming, library upkeep and adherence (Alamer et al., 2023; Bacon & Hoffman, 2020). Automated dispensing cabinets can help to streamline access control and organization of medications, and closed-loop and barcode systems can increase accountability and minimize medication selection mistakes (Zheng et al., 2021). In addition, pharmacist activities in digitally integrated systems of medication can further enhance the identification and resolution of medication-related problems (MRPs) (Berger et al., 2022).

### 6.3 Technology-Related Safety Challenges

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Technology also can bring new types of risk. Too many alerts can cause "alert fatigue" and automation bias can cause clinicians to trust the system's recommendation without checking it out independently. Compensatory strategies may develop when systems are thought to be slow, impractical or not represented well to clinical workflow. Smart infusion pumps are still susceptible to user–technology interaction failures, wrong libraries and programming mistakes (Kirkendall et al., 2020). Poor interface design and fragmented digital systems can therefore alter rather than remove medication risk, which can be addressed through team-ups with designers.Team-ups with designers can therefore help rearrange rather than remove medication risk due to poor interface design and fragmented digital systems. This can only be safely implemented through usability testing, ongoing staff training, periodic system review and nursing clinical judgment preservation and other technological measures.

Table 4 outlines major medication-safety technologies, their principal clinical functions, and the challenges that may arise during implementation.

**Table 4. Technology-Enabled Medication Safety Approaches and Associated Challenges**

| **Technology** | **Medication-safety function** | **Key challenge** |
|---|---|---|
| Electronic medication administration records | Improves documentation and traceability | Poor interface design |
| Barcode medication administration | Confirms patient and medication identity | Workarounds and scanning bypass |
| Computerized provider order entry | Reduces transcription and handwriting errors | Incorrect electronic entry |
| Clinical decision support | Provides allergy, interaction, and dose alerts | Alert fatigue |
| Automated dispensing systems | Controls medication access and selection | Incorrect cabinet selection or stocking |

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| | | |
|---|---|---|
| Smart infusion pumps | Prevents unsafe infusion rates and doses | Programming errors |
| Closed-loop medication systems | Connects prescribing, dispensing, administration, and documentation | Dependence on system integration |
| Electronic alerts | Supports real-time risk identification | Automation bias |

## 7. Medication Safety Culture, Communication, and Interprofessional Collaboration

Decisions and actions around prescribing and administering medicine are not only made by individual clinicians, but are also influenced by the culture of the organization. Safety culture is a just and non-punitive environment that makes it comfortable for nurses to report errors and near misses without a fear of significant retribution or being overly blamed. Reporting is essential because it allows recurrent hazards, workflow weaknesses, and system failures to be identified before similar events cause harm. Nurses, however, might be reluctant to report medication errors due to fear of punishment, reputational issues, uncertainties about reporting procedures, workload, or a belief that reporting will not lead to improvements (Afaya et al., 2021; Braiki et al., 2024). In addition, recent studies suggest that organizational support, managerial response and perceived reporting consequences have a significant impact on nurses' decision to report medication incidents (Yang et al., 2025).

Data from incidents and near-misses have greatest value when turned into learning for the organization. Implementing structured review of medication related events can help with root cause analysis, determine system factors contributing to an event, and inform specific quality improvement efforts. Educational interventions aimed at enhancing reporting of adverse drug events (ADEs) by health care professionals (HCPs) are further evidence that reporting practices can be strengthened through education, through simplified reporting and through supportive feedback systems (Shalviri et al., 2024). Nursing leaders can play an important part in establishing cultures in which the process of reporting is used as a tool for learning and not just a record of personal shortcomings.

Communication is also crucial along the medication-use pathway. Structured handovers can reduce omissions, duplication, and inconsistencies when medication information is transferred between professionals or clinical settings. Medication management is especially vulnerable when transferring patients from intensive care to wards, as treatment, responsibility, and documentation responsibilities may shift creating discontinuities in the management of medications (Bourne et al.,

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2023). Good communication between the nurse and the physician is thus crucial in situations where their orders are ambiguous, patient responses vary, or medication issues might be an concern.

Nurse–pharmacist collaboration is another safety factor that is created by combining the skills and knowledge of the nurse who is at the bedside and the skills and knowledge of the pharmacist who is skilled in medications. There are collaborative models that can be used to review medications, patient education, medication reconciliation, and identification of problems associated with medication use both in the hospital and community, (Ravi et al., 2022). Likewise, the involvement of the pharmacist in multidisciplinary teams has been linked to better detection and management of drug-related problems (Zaij et al., 2023). Strengthening communication, reporting, leadership, and interprofessional collaboration can therefore convert medication safety from an individual responsibility into a shared clinical and organizational function.

## 8. Medication Safety in High-Risk Populations and Clinical Settings

These medication safety issues are exacerbated in populations and settings where treatment is complex, physiological reactions are more unpredictable, and continuity of care is challenging.

### 8.1 Older Adults and Polypharmacy

Older people are considered to be especially at risk due to the high risk of polypharmacy, which can lead to drug interactions, therapeutic duplication, adverse effects, and possible inappropriate medication use (IMU) (Bhagavathula et al., 2021; Tian et al., 2023). Adherence and self-administration may be further complicated by cognitive impairment. Routine review of medicines is thus a critical process in determining whether medicines are still beneficial, potentially harmful, or not in line with current clinical targets. Deprescribing – when done systematically and clinically monitored, can lead to a reduction in unnecessary medication burden (Rodrigues et al., 2022; Thompson & McDonald, 2024). There are also explicit screening guidelines that can assist with the identification of potentially inappropriate medications (PIM) in hospitalised older adults (Alshammari et al., 2021).

### 8.2 Pediatric and Critical Care Patients

Pediatric medication administration presents distinctive challenges because doses frequently require weight-based calculations and individualized preparation. There is a potential for significant differences in dosages due to small mistakes in calculations, especially in neonatal and intensive care units (Alghamdi et al., 2019). Precise dose verification and nursing monitoring is even more important for high alert medications, intravenous medications, and rapidly changing clinical conditions. Medication-related risks in paediatrics can be mitigated through interventions involving the dispensing, administration and monitoring processes (Koeck et al., 2021). Drug-

related hospital admissions are also an indicator of the need for early detection of adverse drug effects and preventable treatment-related harm (Eberl et al., 2024).

### 8.3 Community, Primary, and Transitional Care

Patient safety with medication continues to be at risk once patients are discharged from the hospital and becomes the responsibility of patients, families, caregivers and community professionals. Poor adherence, incomplete medication lists, self-administration difficulties, and discrepancies between hospital and community records may undermine continuity. Intervention in hospital and other intensive care settings to enhance medication safety can be more effective when it reinforces medication reconciliation, communication and follow-up (Bourne et al., 2022). Support from the caregiver, the level of information sharing and inter-service coordination are also considered contextual factors for successful transition for the residents of care homes (Kandiah et al., 2023).

## 9. Implications for Patient Outcomes and Future Nursing Practice

Medication safety has direct implications for clinical outcomes, quality of care and for future nursing practice. Medication-safety interventions can decrease medication administration errors, medication adverse drug events, and improve adherence to medications, treatment outcomes, and continuity of care. Medication optimization at discharge is particularly important because unresolved discrepancies and unclear treatment changes may contribute to avoidable readmissions and post-discharge harm (Wuyts et al., 2025). Likewise, interventions to enhance adherence can boost therapeutic outcomes when they are tailored to overcome patient-specific barriers and foster adherence to medication (Folkvord et al., 2024).

Increased surveillance throughout the medication-use pathway will be needed in the future for nursing practice, especially in medication reconciliation, transitions in care, and follow-up. While nurses have a unique opportunity to identify discrepancies, early signs of adverse effects, and encourage patients to understand medication, these duties should be reinforced by standardized medication-safety indicators and reliable interdisciplinary processes. When medication reviews are conducted by a pharmacist and are part of the whole clinical decision making process and follow up (Craske et al., 2024), they may be used to help improve medication use. Improved nurse–pharmacist partnership can, therefore, improve prevention and continuity of care.

Human factors principles will continue to play a role in the future of the implementation of technology within medication safety, but will continue to be a central focus of medication safety. electronic medication administration records (eMARs) and barcodes need ongoing evaluations as there is the potential for workarounds and overburden of cognitive load if not designed properly (Pruitt et al., 2023). By leveraging human factors and ergonomic methods, technology can be more

effective in protecting patients while better supporting real-world clinical processes and mitigating new medication-related harms (Delaney et al., 2025).

Engagement of the patient and family must also be a priority. Consumer involvement in the design of medication-safety interventions can enhance the relevance and acceptability of the intervention, and involvement in engaging in safer care can bolster participation in safer care (DelDot et al., 2024; Pang et al., 2025). Further research should consider a wider range of settings and resources, involve the use of standard outcome measures and explore whether medication-safety interventions lead to lasting benefits beyond immediate error reduction (WHO, 2023b).

## 10. Conclusion

The issue of medication safety is an important part of quality nursing because nurses are directly engaged in the verification, preparation, administration, monitoring, reconciliation, and education about medications. The review illustrates that medication errors are not necessarily due to an individual, organizational, communication or system error, but to a combination of these. Factors such as knowledge gaps, fatigue, workload and interruptions, incomplete handovers, poor documentation and medication system weaknesses can all contribute to a lack of safe administration, especially in complex clinical settings.

Successful prevention, therefore, involves having standardised medication procedures, competency based education, medication reconciliation, patient engagement, and interprofessional collaboration. While nursing vigilance is still vital, there is a need to reinforce this by establishing organisational systems that minimise unnecessary interruptions, facilitate timely reporting, foster learning from errors and encourage a 'just safety culture'. Electronic records, bar code verification, clinical decision support, automated dispensing, and smart infusion systems can also enhance medication safety with technology. These tools, however, must be used in conjunction with clinical judgment, and usability, workflow, and human factors must be considered in their design.

Specific attention needs to be paid to older people, children, the very sick, and those moving between health-care settings since these groups are at increased risk due to polypharmacy, dose complexity, high-alert medications, and discontinuity of information. Medication monitoring, medication reconciliation, collaborative medication review, and patient involvement should be emphasized in future nursing practice. More uniformity in medication safety signs and longer-term monitoring of intervention effectiveness are also required to identify interventions that result in long-term efficacy. Ultimately, strengthening the skills of the medications provided in skilled nursing practice, coupled with supportive systems, communication, technology, and ongoing organizational learning to minimize patient harm and maximize the quality of care, will ensure medication safety.

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