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Review Article

Medication safety and harm: A narrative review of drug-related errors and adverse outcomes

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Abstract

Background: Medication errors and adverse drug events (ADEs) represent significant threats to patient safety and healthcare quality worldwide. These events contribute to increased morbidity, mortality, and healthcare costs, particularly in vulnerable populations such as the elderly and critically ill. Despite advances in clinical practice and health information technology, drug-related errors remain a persistent challenge.

Objective: This narrative review aims to provide a comprehensive overview of drug-related errors and adverse drug events, examining their types, causes, impacts, and current prevention strategies. It further explores systemic and individual-level factors contributing to medication-related harm and outlines potential directions for improving medication safety in clinical settings.

Materials and Methods: A structured literature search was conducted using databases including PubMed, Scopus, and Google Scholar. Peer-reviewed articles, reports, and guidelines published in English between 2000 and 2024 were included. Data were synthesized narratively to identify key themes and patterns in the literature.

Results: The review identifies prescribing, dispensing, administration, and monitoring errors as common contributors to drug-related harm. Key risk factors include polypharmacy, communication breakdowns, inadequate training, and system inefficiencies. Technological interventions, such as computerized physician order entry (CPOE) and clinical decision support systems (CDSS), have shown promise but require proper implementation and clinician engagement to be effective.

Conclusion: Drug-related errors and ADEs remain a critical concern in healthcare delivery. A multifaceted approach—combining technology, education, system redesign, and policy reform—is essential to mitigate risks and enhance medication safety. Further research is needed to optimize interventions and adapt them across diverse healthcare settings.

Keywords: Medication errors, Adverse drug events, Patient safety, Drug-related harm, Clinical decision support, Pharmacovigilance, Healthcare quality, Risk mitigation

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1. Introduction

Medication use is a cornerstone of modern healthcare, playing a vital role in the prevention, management, and treatment of countless diseases. However, when medications are used inappropriately or errors occur in the medication process, the consequences can be severe—ranging from temporary harm to permanent disability or death. Drug-related errors and adverse drug events (ADEs) are among the most common causes of preventable harm in healthcare systems worldwide.[1]

Medication errors can occur at any stage of the medication-use process, including prescribing, transcribing, dispensing, administration, and monitoring. These errors may result from a variety of factors, such as human mistakes, communication breakdowns, inadequate knowledge, or flaws in healthcare systems and workflows.[2] Adverse drug events, whether preventable or not, often stem from these errors and are particularly prevalent among high-risk populations, such as the elderly, children, and patients with complex medical regimens.

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Globally, the burden of drug-related harm is substantial. The World Health Organization estimates that medication errors cause at least one death every day and injure approximately 1.3 million people annually in the United States alone.[3] These events not only compromise patient safety but also place a significant economic burden on healthcare systems due to extended hospital stays, additional treatments, and legal liabilities.

Efforts to improve medication safety have led to the development of various strategies, including clinical decision support tools, standardized protocols, and safety-oriented organizational cultures. Despite these advancements, drug-related harm remains a pressing issue, warranting continued investigation and systemic improvement.

This narrative review aims to provide a comprehensive understanding of drug-related errors and adverse outcomes by exploring their classifications, underlying causes, risk factors, and current prevention strategies.[4] By synthesizing evidence from a wide range of sources, the review seeks to inform future research and guide healthcare providers, policymakers, and institutions in enhancing medication safety across all care settings.[5]

2. Types of Drug-Related Errors

Drug-related errors encompass a broad range of preventable mistakes that occur during the medication-use process.[6] These errors can arise at any point from prescribing to administration and monitoring, and they may or may not result in harm. Understanding the various types of drug-related errors is essential for identifying vulnerabilities in healthcare systems and implementing targeted safety interventions.

2.1. Prescribing errors

Prescribing errors occur when a healthcare professional selects an inappropriate drug, dose, dosage form, route, or frequency.[7] These errors may result from incomplete patient information, lack of drug knowledge, or failure to consider contraindications or drug interactions. Examples include:

1. Incorrect drug selection (e.g., prescribing a nephrotoxic drug to a patient with renal impairment)
2. Dosage errors (e.g., wrong strength or frequency)
3. Illegible handwriting or ambiguous abbreviations

2.2. Transcription errors

Although becoming less common with the advent of electronic prescribing, transcription errors can still occur when medication orders are transferred manually between documents or systems.[8] These errors may involve:

1. Omission of part of the order
2. Misinterpretation of a written prescription
3. Duplication of therapy

2.3. Dispensing errors

Dispensing errors are mistakes made by pharmacy staff while preparing and supplying medications. These include:

1. Dispensing the wrong drug, dosage form, or strength
2. Labeling errors
3. Failure to detect prescribing errors during medication review.

Dispensing errors can be influenced by look-alike/sound-alike (LASA) drugs, workload pressures, or distractions in the pharmacy environment.[9]

2.4. Administration errors

Administration errors occur when the drug is given to the patient in a manner inconsistent with the prescription or best practice. This category includes:

1. Wrong dose or time of administration
2. Wrong route (e.g., intravenous instead of oral)
3. Omission of a dose
4. Administration to the wrong patient

These errors often occur in high-stress environments, such as hospitals or long-term care facilities, and are frequently associated with interruptions during medication rounds.[10]

2.5. Monitoring errors

Monitoring errors involve the failure to properly observe and respond to a patient's response to a medication. They can lead to delayed detection of adverse effects or therapeutic failure.[11] Examples include:

1. Not ordering necessary lab tests (e.g., INR for warfarin).
2. Ignoring abnormal test results.
3. Inadequate follow-up for drugs with narrow therapeutic indices.

2.6. Documentation errors

Accurate documentation is essential for communication among healthcare providers. Errors in this domain can lead to duplication, omissions, or incorrect assumptions about treatment.[12] Common issues include:

1. Inaccurate or missing entries in the medication administration record (MAR)
2. Failure to update medication lists
3. Miscommunication during transitions of care

3. Materials and Methods

This narrative review was conducted to synthesize current knowledge on drug-related errors and adverse drug events, focusing on their types, causes, consequences, and preventive strategies. A narrative review approach was selected due to its flexibility in exploring complex, multifactorial healthcare

issues and its ability to integrate findings from diverse study designs and sources.

3.1. Search strategy

A comprehensive literature search was conducted using the following electronic databases: PubMed, Scopus, Web of Science, and Google Scholar**.** The search included peer-reviewed journal articles, guidelines, and reports published in English from January 2000 to March 2024**.**

The following keywords and Boolean operators were used in variouscombinations: ″medication errors," "adverse drug events," "drug-related harm," "medication safety," "prescribing errors," "dispensing errors," "clinical decision support," "pharmacovigilance," "patient safety," *and* "preventable adverse events."

Additional articles were identified by examining the reference lists of key studies and review articles.

3.2. Inclusion and exclusion criteria

3.2.1. Inclusion criteria

Articles focused on drug-related errors or adverse drug events in any healthcare setting.
Studies discussing causes, risk factors, outcomes, or interventions.
Narrative reviews, systematic reviews, observational studies, clinical trials, and official reports.

3.2.2. Exclusion criteria

1. Non-English language publications.
2. Conference abstracts without full-text availability.
3. Studies unrelated to human healthcare (e.g., veterinary medicine).
4. Articles focused solely on pharmacokinetics or pharmacodynamics without relevance to safety or error.

3.2.3. Data extraction and synthesis

Relevant data were extracted manually and categorized based on the type of drug-related error, contributing factors, outcomes, and prevention strategies. Given the narrative nature of the review, no formal quality appraisal or meta-analysis was conducted. Instead, a thematic synthesis approach was used to identify recurring patterns, insights, and gaps across the literature.

The review prioritizes breadth and integrative insight over quantitative analysis, aiming to inform both clinical practice and policy by providing a comprehensive overview of current knowledge and challenges in medication safety.

4. Results

The findings of this narrative review are organized into several key thematic categories that emerged consistently across the literature. These include the prevalence and types of drug-related errors, contributing factors, populations at risk, and strategies for prevention.

4.1. Prevalence and burden of drug-related errors and adverse events

Studies consistently indicate that drug-related errors and adverse drug events (ADEs) are common across all healthcare settings. In hospital environments, medication errors are estimated to affect up to 5–10% of inpatients**,** with ADEs contributing significantly to morbidity and extended hospital stays. Primary care and outpatient settings are also affected, particularly due to issues in prescribing and patient self-administration. The economic burden includes direct costs (hospitalization, treatments) and indirect costs (lost productivity, legal claims).

4.2. Common types of errors identified

A wide range of errors were identified, including:

1. **Prescribing errors**, such as inappropriate drug selection or dosing
2. **Dispensing errors**, particularly involving look-alike/sound-alike (LASA) medications
3. **Administration errors**, especially in high-acuity settings like ICUs and emergency departments
4. **Monitoring errors**, often involving a failure to follow up with necessary lab testing (e.g., INR monitoring for warfarin).

Errors at each stage can act cumulatively, leading to serious patient harm if not intercepted.

4.3. Contributing factors

Multiple interrelated factors were found to contribute to drug-related errors:

1. **Human factors**, such as fatigue, inexperience, or miscommunication among healthcare providers.
2. **System-level issues**, including poor workflow design, lack of standardization, and suboptimal electronic health record (EHR) usability.
3. **Environmental stressors**, such as high patient volume and interruptions during medication administration rounds.

Technological factors also played a dual role—serving as both a potential solution and a source of new error types (e.g., alert fatigue from clinical decision support systems).

5. High-Risk Populations and Settings

Certain populations are disproportionately affected by medication errors and ADEs:

1. **Elderly patients**, due to polypharmacy and altered pharmacokinetics.
2. **Pediatric patients**, due to weight-based dosing complexities.

3. **Patients with multiple comorbidities**, especially those undergoing transitions of care.

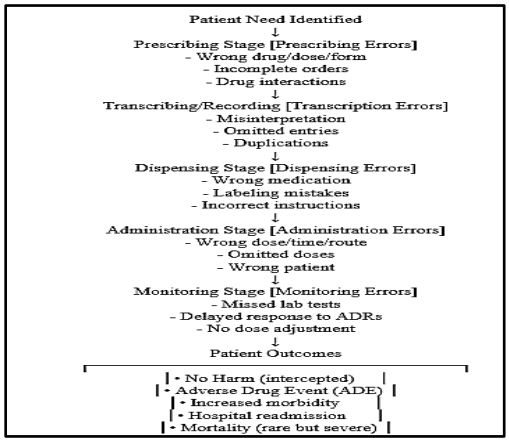
High-risk settings include intensive care units, surgical wards, and long-term care facilities, where complex medication regimens and communication challenges are common.

5. Effective Prevention Strategies

The literature highlights several evidence-based strategies for reducing medication-related harm:

1. **Technological interventions**, including computerized physician order entry (CPOE), barcoding, and clinical. decision support systems (CDSS), have shown moderate success when well-integrated.
2. **Standardized protocols** and checklists improve consistency and reduce reliance on memory
3. **Pharmacist-led interventions**—such as medication reconciliation and ward-based clinical pharmacy services—are particularly effective.
4. **Training and education**, particularly interprofessional education, improves awareness and collaboration in safe medication practices.

Despite these strategies, many interventions require consistent implementation, ongoing evaluation, and institutional support to be effective.



6. Discussion

This narrative review highlights the ongoing and multifaceted challenges posed by drug-related errors and adverse drug events (ADEs) across healthcare systems.[13] Despite growing awareness, advances in health information technology, and policy-level interventions, medication-related harm continues to be a leading cause of preventable morbidity, especially in high-risk settings and populations.[14]

6.1. Interpreting the findings

The evidence clearly shows that medication errors occur throughout the medication-use process, from prescribing and dispensing to administration and monitoring.[15] Among these, prescribing errors are particularly prevalent and have a high potential for downstream consequences if not intercepted.[16] Dispensing and administration errors**,** often influenced by environmental stressors and human factors, further compound the risk of patient harm. Errors in the monitoring phase, although sometimes overlooked, are critical in managing high-risk medications and preventing long-term complications.[17]

The review also underscores that certain patient groups—including the elderly, children, and those with chronic diseases—are disproportionately affected. These populations frequently experience polypharmacy, complex regimens, and care transitions, all of which increase the likelihood of errors and ADEs.

6.2. Systemic and human factors

Medication safety is influenced by both individual performance and system-level design. Communication failures, knowledge deficits, interruptions, and fatigue are key contributors at the individual level.[8] At the system level, flawed processes, inadequate technology integration, and poor safety culture hinder efforts to reduce errors. The interaction between these two levels is critical; for example, a poorly designed electronic prescribing system can increase cognitive workload and lead to errors, even among well-trained professionals.[19]

Technological tools such as computerized physician order entry (CPOE)**,** clinical decision support systems (CDSS)**,** and barcoding have demonstrated potential in reducing certain types of errors. However, their effectiveness is highly dependent on usability, staff training, and proper implementation. Alarm fatigue, over-reliance on automation, and system overrides can undermine these tools if not carefully managed.[20]

6.3. Effectiveness of interventions

Multifaceted interventions tend to be more effective than single-strategy approaches. For example, combining CPOE with pharmacist-led medication reconciliation and staff education programs provides a layered defense against errors. Involving clinical pharmacists in direct patient care has been repeatedly shown to reduce prescribing and administration errors, especially in hospitals and long-term care settings.[21]

Another promising approach involves interprofessional collaboration and shared accountability. Training programs that foster teamwork and communication between physicians, nurses, and pharmacists can help close safety gaps, particularly during high-risk transitions of care such as hospital discharge.

7. Implications for Practice and Policy

To improve medication safety on a systemic level, healthcare institutions must prioritize:

1. A just culture that encourages error reporting without fear of punishment.
2. Standardized protocols for high-alert medications
3. Investments in health IT systems that are user-centered and interoperable.
4. Regular training and competency assessments for healthcare providers.

On a policy level, regulators and accrediting bodies can promote safety by mandating error tracking, integrating medication safety into quality metrics, and supporting the development of national and international reporting systems.

8. Limitations of Current Evidence

While this review synthesizes findings from a broad array of sources, it is limited by the narrative design, which does not include formal meta-analysis or risk of bias assessment. The heterogeneity in definitions, data sources, and reporting practices across studies also limits direct comparison. Additionally, much of the literature focuses on hospital settings, with less robust data available for community care, home settings, and developing countries.

9. Future Directions

Future research should focus on:

1. Longitudinal studies evaluating the sustained impact of safety interventions.
2. Innovations in predictive analytics and artificial intelligence to prevent errors in real time.
3. Greater inclusion of patient and caregiver roles in medication safety efforts.
4. Developing global frameworks for harmonizing reporting and response to drug-related harm.

10. Conclusion

Drug-related errors and adverse drug events represent preventable yet persistent threats to patient safety. Addressing these challenges requires a comprehensive, system-wide approach involving technology, workforce education, clinical leadership, and patient engagement. By transforming both practice and culture, healthcare systems can move closer to the goal of zero preventable medication harm.

11. Source of Funding

None.

12. Conflict of Interest

None.

References

1. Gilbert AL, Roughead EE, Mott K, Barratt JD, Beilby J. Collaborative medication management services: improving patient care. *Med J Aust*. 2002;177(4):189-92.
2. Bates DW. Preventing medication errors: a summary. *Am J Health System Pharma*. 2007;64(149):3-9.
3. Vanwesemael T, Boussery K, Manias E, Petrovic M, Fraeyman J, Dilles T. Self- management of medication during hospitalisation: Healthcare providers' and patients' perspectives. *J Clin Nurs.* 2018;27(3-4):753-68.
4. Mira JJ, Lorenzo S, Guilabert M, Navarro I, Perez-Jover V. A systematic review of patient medication error on selfadministering medication at home. *Expert Opin Drug Safety*. 2015;14(6):815- 38.
5. Ferner RE, Aronson JK. Clarification of terminology in medication errors: definitions and classification. Drug Safety. 2006;29:1011-22.
6. Ylä-Rautio H, Siissalo S, Leikola S. Drugrelated problems and pharmacy interventions in non-prescription medication, with a focus on high-risk over-the-counter medications. *Int J Clin Pharm*. 2020;42(2):786-95.
7. Chamberlain C, Kortepeter C, Muñoz M. Clinical analysis of adverse drug reactions and pharmacovigilance. Atkinson's Princ Clin Pharmacol Elsevier; 2022;499-517.
8. Shearer D, Baker DW. The Joint Commission Journal on Quality and Patient Safety Adds New Editors to Team. *Joint Commis J Qual Patient Saf*. 2023;49(12):655-732
9. Soldatos TG, Jackson DB, editors. Adverse event circumstances and the case of drug interactions. Healthcare; 2019: MDPI.
10. Lucas S, Ailani J, Smith TR, Abdrabboh A, Xue F, Navetta MS. Pharmacovigilance: reporting requirements throughout a product's lifecycle. *Therap Adv Drug Saf*. 2022;13:
11. Lisby M, Nielsen LP, Brock B, Mainz J. How are medication errors defined? A systematic literature review of definitions and characteristics. *Int J Qual Health Care*. 2010;22(6):507-18.
12. NCCMERP. National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP). About Medication Errors: What is a Medication. 2015.
13. Observatory NPSAPS. Safety in doses: medication safety incidents in the NHS: National Patient Safety Agency; 2007.
14. Carver N, Gupta V, Hipskind JE. Medical Errors. StatPearls [Internet]: StatPearls Publishing; 2023.
15. Ellahham S. The Domino Effect of Medical Errors. *Am J Med Qual.* 2019;34(4):412-3.
16. Dean B, Barber N, Schachter M. What is a prescribing error? BMJ Quality & Safety. 2000;9(4):232-7.
17. Aronson JK. Medication errors: definitions and classification. *Brit J Clin Pharmacol.* 2009;67(6):599-604.
18. Lewis PJ, Dornan T, Taylor D, Tully MP, Wass V, Ashcroft DM. Prevalence, incidence and nature of prescribing errors in hospital inpatients: a systematic review. *Drug Saf*. 2009;32:379-89.
19. Franklin BD, Reynolds M, Shebl NA, Burnett S, Jacklin A. Prescribing errors in hospital inpatients: a three-centre study of their prevalence, types and causes. *Postg Med J.* 2011;87(1033):739-45.
20. Keers RN, Williams SD, Vattakatuchery JJ, Brown P, Miller J, Prescott L, et al. Prevalence, nature and predictors of prescribing errors in mental health hospitals: a prospective multicentre study. *BMJ open*. 2014;4(9):e006084.
21. Ryan C, Ross S, Davey P, Duncan EM, Francis JJ, Fielding S, et al. Prevalence and causes of prescribing errors: the PRescribing Outcomes for Trainee Doctors Engaged in Clinical Training (Protect) study. *PloS one*. 2014;9(1):e79802.

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