

Assessment of Pediatric Drug Dosing Errors and Strategies for Prevention in Hospital Settings

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DESCRIPTION

Medication errors in pediatric hospital settings represent a significant patient safety concern worldwide, with drug dosing errors being among the most frequent and potentially harmful types. Unlike adults, children require individualized dosing calculations based on weight, age, and developmental factors, making pediatric prescribing inherently complex and prone to mistakes. In high-income countries with advanced healthcare systems, despite numerous safety protocols, pediatric drug dosing errors continue to occur, highlighting the need for ongoing assessment and effective prevention strategies.

Pediatric drug dosing errors may arise at any stage of the medication process: prescribing, dispensing, administration, or monitoring. These errors can lead to underdoing, resulting in therapeutic failure, or overdosing, which increases the risk of toxicity and adverse drug reactions. The consequences of dosing errors in children can be severe due to their smaller therapeutic margins and differing pharmacokinetics compared to adults. Recent studies in hospital settings across Europe, North America and Australia reveal dosing errors account for a substantial proportion of pediatric medication mistakes. Common causes include calculation errors, incorrect weight documentation, use of adult formulations, misinterpretation of guidelines and communication breakdowns among healthcare professionals. Factors such as emergency situations, high workload and interruptions during medication preparation further elevate error risks.

High-income countries have invested in systems to reduce these errors, including electronic prescribing systems with integrated pediatric dosing calculators, standardized dosing charts, barcoding of medications and clinical pharmacist involvement. These interventions have demonstrated success in decreasing errors but are not fool proof. For example, errors can still occur due to incorrect data entry, outdated formularies, or failure to update patient weights regularly. A critical element in assessing dosing errors is accurate reporting and data collection. Voluntary reporting systems, incident reviews and direct observation studies have uncovered that many errors go

unreported due to fear of blame or lack of time. Creating a non-punitive culture that encourages transparent reporting is essential to understanding error patterns and implementing targeted solutions.

Education and training of healthcare staff, including physicians, nurses and pharmacists, are foundational in preventing dosing errors. pediatric-specific pharmacology knowledge, weight-based dosing principles and familiarity with hospital protocols should be emphasized in continuous professional development. Simulation-based training can help teams practice medication preparation and administration in a controlled, risk-free environment. Involving families in the medication process is another emerging strategy. Parents or caregivers, familiar with the child's usual medication regimens, can serve as an additional checkpoint to verify correct drugs and doses. Empowering families with information about dosing and potential side effects supports a culture of safety.

Multidisciplinary collaboration is important. Pharmacists play a important role in reviewing prescriptions, identifying potential errors and providing guidance on appropriate dosing. Nurses' vigilant administration practices and prompt communication of concerns complement this safety net. Integrating these roles into hospital protocols fosters shared responsibility and reduces fragmentation of care. Despite advancements, challenges remain in standardizing pediatric dosing practices due to variations in drug availability, formulation strengths and institutional guidelines. Developing universally accepted pediatric dosing references and harmonizing Electronic Health Record (EHR) systems could mitigate these inconsistencies.

Furthermore, advances in technology offer potential avenues. Artificial Intelligence (AI) and machine learning algorithms have potential to predict high-risk prescriptions, alert clinicians in real-time and personalize dosing recommendations based on patient-specific data. However, these tools require accurate validation and integration into clinical workflows. In summary, while pediatric drug dosing errors remain a critical issue in hospital settings even in high-income countries, a multifaceted approach encompassing technology, education, culture change and system redesign offers the best chance of prevention.

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CONCLUSION

Pediatric drug dosing errors in hospital settings continue to pose a significant threat to child patient safety, necessitating urgent and sustained efforts to mitigate risks. The complexity of pediatric dosing demands specialized knowledge, meticulous processes and robust systems that minimize human error. High-income countries have made commendable progress through electronic prescribing, clinical pharmacist involvement and standardized protocols. Yet, persistent errors highlight gaps in practice and the need for continuous improvement. Cultivating a blame-free reporting culture, enhancing staff training and engaging families are critical components of a comprehensive safety strategy.

Looking ahead, embracing technological innovations such as AI-driven decision support holds promise but must be implemented thoughtfully alongside human expertise. Standardizing pediatric dosing references and integrating multidisciplinary teamwork will further strengthen defences against errors. Ultimately, ensuring safe pediatric medication practices requires commitment at all levels from frontline clinicians to healthcare administrators and policymakers. By prioritizing prevention of dosing errors, hospitals can significantly reduce adverse drug events, improve therapeutic outcomes and safeguard the health of vulnerable children entrusted to their care.