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A Comprehensive Review of Medication Errors in Pediatrics and Adults: Types, Causes, And the Role of The Pharmacist in Prevention

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ABSTRACT

Medication errors are a significant cause of morbidity and mortality globally, particularly in hospital settings. This comprehensive review explores the types, causes, and strategies for preventing medication errors in pediatric and adult populations, with a focus on the critical role of pharmacists. Medication errors can occur at any stage of the therapeutic management process, including prescribing, transcribing, dispensing, preparing and administering, and monitoring medications and patients. Prescribing errors, such as incorrect dosage or route, are particularly concerning in pediatric settings where precise dosing is crucial. Dispensing errors, including wrong medication or incorrect storage, can lead to adverse effects or treatment failure. Preparation and administration errors, such as route errors or omissions, pose significant risks, especially in high-stakes environments like intensive care units. Transcribing errors, including omissions and incorrect entries, can result in discrepancies from the original physician's order. Monitoring errors, such as failure to review prescribed regimens or use appropriate clinical data, can lead to adverse drug events. Various factors contribute to medication errors, including provider knowledge, environmental distractions, and process-related issues. Strategies to reduce errors include clear communication, enhanced training, electronic

prescribing, quiet environments, and non-punitive reporting systems. Pharmacists play a vital role in preventing medication errors by managing and dispensing medications, providing drug information, ensuring medication safety, educating patients, and offering clinical pharmacy services. Their expertise in prescription handling, dosage modifications, and drug interactions is crucial for safe and effective medication therapy. Implementing standardized protocols, leveraging technology, fostering a safety culture, and promoting continuous education are essential for reducing medication errors and improving patient outcomes.

KEYWORDS: Medication Errors, Pharmacist Role in Error Prevention, Types Of Medication Errors, Causes Of Medication Errors, Medication Safety In Paediatrics, Adult Medication Errors.

1. Introduction

Medications are used generally to help improve health and decrease morbidity and mortality (Avery, 2003). There is an undoubtedly positive effect of using medications for treating and preventing diseases, but only if they are used safely and effectively. Improving patient health is an important goal to be achieved by healthcare facilities which can be improved by preventing medication errors (Lehmann & Kim, 2005). Medication errors comprise the largest portion of all types of medical errors (Medicine & America, 2000). Medication errors might occur at any stage of therapeutic management (Engum & Breckler, 2008). This involves the prescribing, transcribing, dispensing, preparing and administering, monitoring and documentation of medications and patients (Kaushal et al., 2004). According to these stages, all healthcare providers taking part in therapeutic management may be involved in medication errors. It is important to find solutions to decrease harmful and potentially deadly errors (Hicks et al., 2008).

Medication errors are a major cause of morbidity and mortality globally, especially in hospital settings. Pharmacists are key members of the healthcare team who help to reduce medication errors in hospitals. Pharmacists' primary obligation is to ensure that patients use their prescriptions safely and effectively (Gupta et al., 2023; Pham et al., 2011).

The treatment plan for each patient is a multidisciplinary process that includes prescribing, dispensing, administering medications, and monitoring the patient by healthcare specialists at the healthcare institute. This approach intends to improve patient health and save lives (Khowaja et al., 2008). Medication errors (MEs) can occur at any stage of the treatment plan, potentially leading to treatment failure and/or patient harm (Ferner & Aronson, 2006).

Definitions of medication errors Terminology around the subject of medication errors can be confusing with numerous definitions having been used. Some examples are given below:

- Medical errors: “All errors that occur within the healthcare system

including mishandled surgery, diagnostic errors, equipment failures, and medication errors" (M. A. Ghaleb et al., 2006).

- Medication error: "Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labelling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use" (National Coordinating Council for Medication Error Reporting and Prevention | NCC MERP, n.d.).

- Medication error: "A mistake made at any stage in the provision of a pharmaceutical product to a patient" (Wilson et al., 1998).

- Medication error: "Any error in the medication use process including drug ordering, transcribing, dispensing, administering, or monitoring" (Kaushal et al., 2004).

Medication errors can be caused by a variety of factors, including: (1) personal factors, such as inadequate knowledge, prescribing problems, poor handwriting, inaccurate dosage calculations, incorrect dosage forms or strengths, incorrect methods or routes of administration, incorrect patient orders or dispenses, errors in preparation and labelling, or unclear directions of use; and (2) environmental factors, such as incorrect storage conditions, such as heat or light, improper workload noise, or improper packaging (Al-Worafi, 2018; Sinha et al., 2016).

MEs are not just created by doctors; they involve patients, pharmaceutical producers, and other healthcare professionals like pharmacists, dentists, and nurses ("The Prevalence of Adverse Drug Event-related Admissions at a Local Hospital in Malaysia," 2013). Errors that cause morbidity and mortality might be as minor as inconspicuous mistakes or as significant as major errors. A longer hospital stay, the need for further medical care and treatments, and decreased production (due to time lost in the hospital) are additional financial repercussions of these errors (Walsh et al., 2017). Moreover, MEs have psychological repercussions that impair patients' trust in their healthcare system, which in turn affects their compliance and treatment adherence (Patanwala et al., 2010).

Around the world, medication errors are a very widespread issue. According to a recent study, there were around 237 million MEs in primary and secondary care settings in the UK last year, costing the National Health Service £98 million (Elliott et al., 2021). According to studies, the prevalence of MEs in children is three times higher (1.1%) than in adults (0.35%) (Kaushal et al., 2001). Because pediatric drugs are prescribed according to the patient's weight or surface area, exact dosage estimates are necessary. Additionally, confusion and errors might result from the presence or absence of various dose forms and strengths. Along with the metabolic and elimination systems' poor development in premature newborns up until six months of age, these patients are more likely to have errors or toxicity (Kaushal et al., 2001).

Classification of medication errors

According to the stages of therapeutic management; errors can be classified into five types: prescribing, transcribing, dispensing, preparing and administering, and monitoring of medications and patients (Kaushal et al., 2004).

Prescribing errors

Prescribing errors are defined as "a clinically meaningful prescribing error occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant reduction in the probability of treatment being timely and effective or an increase in the risk of harm when compared with generally accepted practice" (M. A. Ghaleb et al., 2005). These errors can involve incomplete prescriptions, incorrect drug, dose, frequency, infusion rate, route of administration, quantity, or patient, as well as failure to consider factors such as patient weight, contraindications, and drug interactions (M. A. Ghaleb et al., 2010). Such errors are particularly concerning in pediatric settings where accurate dosing is essential for patient safety, as children are highly sensitive to medication variances.

Frequency and Scope of Prescribing Errors

The frequency of prescribing errors varies widely due to differences in healthcare settings, detection methods, and definitions of errors. Studies using chart reviews often report higher error rates than those relying on incident reports, with some studies identifying prescribing errors in up to 50% of all documented medication errors (Takata et al., 2008). In pediatric and neonatal units, where precision in prescribing is crucial, Takata et al. (2008) identified a prescribing error rate of 0.82 per 1,000 orders in U.S. children's hospitals, underscoring the need for stringent checks in high-risk areas.

International studies reveal similarly variable rates. For example, research in primary care centers in Bahrain found error rates as high as 90.5% in some cases, while studies in U.K. hospitals have shown rates of 7% for newly graduated doctors (Dornan et al., 2009). These differences illustrate that prescribing errors are widespread across diverse healthcare systems and settings.

Types of Prescribing Errors

Prescribing errors can be categorized into omissions, commissions, and knowledge-based errors:

- Omission Errors: Missing essential prescription components like dosage, route, or patient identifiers.
- Commission Errors: Incorrectly written components, such as dose or frequency.
- Knowledge-Based Errors: These involve drug-drug interactions, allergies, or failure to integrate relevant patient information.

In pediatrics, tenfold errors are particularly problematic, as seen when doses are

mistakenly increased by a factor of ten (e.g., 5 mg instead of 0.5 mg), which can lead to severe toxicity, especially with narrow therapeutic index drugs (Kozer, Scolnik, Keays, et al., 2002).

Contributing Factors to Prescribing Errors

Several factors contribute to prescribing errors, categorized into provider, environmental, and process-related issues:

- Provider Factors: Insufficient knowledge of pharmacology, inadequate understanding of pediatric dosing, and lack of training. Studies indicate that junior doctors, who may not feel adequately prepared for prescribing, are often responsible for a high proportion of these errors (Han & Maxwell, 2006).

- Environmental Factors: High-stress settings, noise, and poor communication in team settings are significant contributors. For example, emergency departments, where time pressure is intense, tend to have higher error rates.

- Process-Related Issues: Use of verbal orders, illegible handwriting, calculation mistakes, and Look-Alike, Sound-Alike (LASA) drugs increase the risk of errors. These issues are further compounded by systemic challenges, such as unclear instructions and a lack of standardized protocols.

Strategies for Reducing Prescribing Errors

A range of strategies has been proposed to reduce prescribing errors, emphasizing education, system improvements, and technology:

1. Clear Communication and Documentation: Prescribers are encouraged to communicate effectively with other healthcare providers and complete prescriptions with all required information, avoiding abbreviations and verbal orders whenever possible (Stucky et al., 2003).

2. Use of Generic Names and Avoidance of Ambiguous Abbreviations: Standardizing terminology and eliminating ambiguous abbreviations reduces the likelihood of misinterpretation in prescriptions (Neelakantan et al., 2024).

3. Enhanced Training and Education: Continuous education on drug interactions, pediatric dosing, and contraindications is essential, particularly for junior doctors and trainees who handle a substantial volume of prescriptions.

4. Electronic Prescribing and Reliable Equipment: The use of computerized provider order entry (CPOE) systems helps prevent transcription errors and calculation mistakes, particularly for pediatric dosages (M. Ghaleb, 2006).

5. Quiet, Organized Environments: Minimizing distractions and interruptions in high-risk settings, like ICUs and emergency departments, enhances focus during the prescribing process (Stucky et al., 2003).

6. Non-Punitive Reporting Systems: Encouraging the reporting of errors without fear of punishment helps create a culture of transparency and allows healthcare providers to learn from incidents (Stucky et al., 2003).

7. Regular LASA Drug Reviews: Periodically reviewing look-alike and

sound-alike drugs and educating providers on their risks helps mitigate errors caused by drug similarity (Patient Safety Solution, n.d.).

Prescribing errors are a critical concern in healthcare, especially in pediatric settings where small dosing inaccuracies can have significant repercussions. With variations in error rates across settings, a combination of targeted training, system-wide protocol standardization, technology adoption, and environmental adjustments is essential to minimize these errors. Establishing robust reporting mechanisms and fostering a non-punitive culture are further vital steps toward improving prescribing accuracy and enhancing patient safety across healthcare institutions.

Dispensing errors

Dispensing errors are defined as “any deviation from the medical prescription in dispensing medication” (Costa et al., 2008). These errors can occur at any stage in the dispensing process, from receiving the prescription to supplying the medication to the patient. Typical dispensing errors include incorrect dose, drug, concentration, dosage form, or patient; missing doses; omitting drugs; dispensing expired medications; and improper storage of medications. Errors may also arise from typing mistakes during computerised labelling, such as incorrect drug or patient names, dosage forms, quantities, and instructions. Selecting the wrong drug from a patient’s record is another common error (James et al., 2009).

Frequency and Scope of Dispensing Errors

The prevalence of dispensing errors is highly variable across studies, influenced by the settings and methodologies used to capture data. Studies often use incident reporting systems, chart reviews, or direct observations to identify these errors, each method with its limitations and strengths. Incident reports typically show higher error rates, indicating that real-time observations may provide a more comprehensive view of the types of errors occurring. Research in pediatric hospitals has highlighted these errors as particularly frequent, with rates ranging from 11.8% to 35.7% of all medication errors depending on the data collection method used.

Common Types of Dispensing Errors

Dispensing errors manifest in several key forms that can significantly impact patient safety:

- Wrong medication: Dispensing an incorrect drug, which can lead to adverse effects if the patient has allergies or contraindications.
- Incorrect dose: Errors in drug strength or quantity, posing a high risk in medications with narrow therapeutic windows.
- Inappropriate storage: Storing medications improperly can reduce their effectiveness or safety, especially those sensitive to light, temperature, or humidity.
- Omission of medication: Failing to provide a prescribed medication or dose, which can lead to treatment failure.

- Labelling errors: Typographical errors in computerized systems can mislabel drugs, doses, or instructions, leading to improper use by patients or caregivers.

Contributing Factors to Dispensing Errors

Several factors contribute to the occurrence of dispensing errors. These include:

- Look-Alike, Sound-Alike (LASA) medications: Drugs with similar names or packaging are often confused, leading to selection errors (James et al., 2009).
- Poor handwriting on prescriptions, which can be misinterpreted during transcription.
- Unclear instructions and lack of standardization in prescription formats, leading to ambiguity in dispensing.
- Environmental distractions: Noise, interruptions, and inadequate lighting can reduce focus, making errors more likely.
- Workload and stress: High volumes of prescriptions, coupled with insufficient breaks and staffing, contribute to errors as healthcare workers are pressed for time.
- Inadequate training and experience: A lack of sufficient training in handling specific medications or labelling equipment can also result in mistakes.
- Failure to adhere to guidelines and inadequate organization of drugs on shelves further increase the risk of selecting the wrong medication.

Strategies for Reducing Dispensing Errors

To minimize dispensing errors, a variety of strategies have been recommended:

1. Strict Adherence to Dispensing Protocols: Following standardized steps in the dispensing process ensures consistency and reduces the chance of skipping essential checks.
2. Enhanced Care with High-Risk Drugs: Healthcare providers should handle LASA drugs and high-alert medications like potassium chloride, heparin, and insulin with extra caution, including storing these separately to prevent mix-ups.
3. Creation of Quiet Zones: Working in an environment free from distractions, with clear lighting and minimized interruptions, allows pharmacy staff to concentrate fully on dispensing tasks.
4. Verification and Double-Checking: Checking that prescriptions are accurate, fully completed, and checked for drug interactions, duplication, and allergy information before dispensing enhances safety (Nair et al., 2010).
5. Clear Labelling and Minimization of Abbreviations: Labels should be clear, standardized, and free from ambiguous abbreviations to prevent misunderstandings.
6. Utilization of Reliable Technology: Barcode scanning and electronic labelling systems can assist in ensuring that the correct medication is provided,

helping to avoid selection errors and reduce time spent on manual checks.

7. Reduction of Workload: By balancing staffing and workload, healthcare facilities can reduce the physical and mental strain on pharmacy staff, which in turn lowers the risk of errors.

8. Education and Training: Providing regular training on handling specific medications, dispensing protocols, and new equipment is essential for error prevention.

9. Encouraging a Non-Punitive Reporting Culture: Fostering an environment where staff can report errors without fear of punishment promotes transparency and allows facilities to learn from these incidents to improve processes.

Dispensing errors remain a prevalent challenge in healthcare, especially in high-stakes environments such as pediatric and intensive care units. The wide range of factors contributing to these errors underscores the need for a multifaceted approach to prevention, involving systematic protocol adherence, improved work environments, and continuous staff education. With strategies such as double-checking protocols, integration of reliable technology, and fostering an open reporting culture, healthcare facilities can better safeguard against dispensing errors, ultimately contributing to safer and more effective patient care.

Preparation and administration errors

Preparation and administration errors are defined as “deviations from the prescribed dose or hospital policy, including errors in preparing and administering medications, particularly intravenous drugs” (M. A. Ghaleb et al., 2010). These errors represent one of the most critical points in medication management, as they occur at the final stage and are difficult to prevent, often resulting in significant harm to patients if not intercepted (van den Bemt et al., 2007). The “Five Rights” principle: right dose, right drug, right patient, right time, and right route, is fundamental for healthcare professionals to prevent such errors during administration. However, complex factors continue to contribute to preparation and administration errors, making them persistent in healthcare settings.

Frequency and Scope of Preparation and Administration Errors

The incidence of preparation and administration errors varies widely, reflecting differences in detection methods and healthcare settings. Studies in both pediatric and adult settings highlight these errors as a major cause of adverse drug events (ADEs), with high rates observed particularly in high-risk areas such as intensive care units (ICUs) have shown that errors are more frequently detected during direct observation and incident reporting than in retrospective chart reviews, suggesting that real-time monitoring can reveal additional risks that may otherwise go unnoticed.

Types of Preparation and Administration Errors

Preparation and administration errors encompass a range of issues, including:

- Route errors: Administering medication via the incorrect route can be fatal, as seen with drugs like vincristine, which can cause death if administered intrathecally instead of intravenously.
- Omissions: Skipping doses is a common error, often due to forgetfulness or miscommunication.
- Wrong dosage or expired medications: Providing incorrect doses or administering expired drugs can severely affect treatment outcomes and patient safety.
- Timing errors: Administering drugs at incorrect times can compromise therapeutic effectiveness, especially for time-sensitive medications.
- Incorrect rate or technique: Errors in the infusion rate or improper preparation techniques can result in adverse reactions and reduced drug efficacy.

These errors under comprehensive training, clear communication, and strict adherence to protocols to ensure patient safety.

Contributing Factors to Preparation and Administration Errors

Preparation and administration errors often stem from systemic and human factors. Major contributors include:

- Lack of knowledge about the medication: Insufficient understanding of proper administration techniques and associated risks increases the likelihood of errors.
- Environmental distractions: High noise levels, frequent interruptions, and poor lighting contribute to loss of focus, leading to mistakes.
- Complexity of equipment: Misuse of infusion pumps and other delivery devices can result in administration errors, especially when training is inadequate.
- Similar appearance of medications: Storing look-alike medications together creates a risk of selection errors, further exacerbated by high workloads.

Research consistently shows that overburns environments contribute to errors by creating conditions in which healthcare professionals may overlook critical steps.

Strategies for Reducing Preparation and Administration Errors:

1. Verification Protocols: Before administration, staff should verify the patient's identity and confirm medication details with the administration record to ensure accuracy.
2. Double-Check Systems: For high-risk medications, a second healthcare professional should review calculations and verify dosing to prevent mistakes.
3. Use of Quiet Zones: Designating quiet areas for preparation and administration reduces distractions, allowing staff to focus on the task at hand.
4. Enhanced Training on Equipment: Familiarity with equipment like infusion pumps and syringe drivers is essential, especially when new devices are introduced.

Periodic training sessions are recommended to maintain proficiency.

5. Error-Reducing Technology: Barcoding and automated medication dispensing systems can help minimize selection errors, while electronic alerts assist in monitoring timing and dosage.

6. Non-Punitive Reporting Systems: Encouraging staff to report incidents without fear of punishment promotes transparency and helps institutions identify patterns and underlying causes of errors.

7. Educational Programs for Parents and Caregivers: Since caregivers play a role in medication administration, particularly in pediatric cases, providing education on accurate dosing tools and label interpretation can prevent errors at home.

Preparation and administration errors pose a significant care, especially in high-stakes environments like pediatric and neonatal units where precision in dosing and timing is essential. Although adherence to the "Five Rights" principle is crucial, mitigating these errors requires systemic changes, including standardized protocols, staff training, and supportive technology. Continuous efforts to improve the healthcare environment and foster a culture of open error reporting are essential in addressing preparation and administration errors, ultimately leading to safer patient care.

Transcribing error

Transcribing errors are defined as “errors that occur after the prescription stage,” encompassing mistakes made during the process of recording the prescribed dose, route, or timing of a medication onto a medical record or nursing report (James et al., 2009). These errors can result in discrepancies from the original physician’s order and are particularly impactful in pediatric and neonatal settings, where precise medication dosing and timing are critical due to the vulnerability of the patient population.

Frequency and Scope of Transcribing Errors

The prevalence of transcribing errors varies across studies, largely depending on the methodology used for detection. Studies using incident reporting systems often report higher frequencies of transcribing errors than those relying on chart reviews or direct observation. For example, Takata et al. (2008) observed no transcribing errors in a chart review, whereas Miller et al. (2010) reported that transcribing errors accounted for 24.2% of all detected errors using an incident reporting system. These differences suggest that transcribing errors may be underreported or overlooked when using certain data collection methods.

In international studies, the frequency of transcribing errors also differs based on local practices and healthcare systems. In a Spanish neonatal unit, Campino et al. (2006) found that transcribing errors constituted 21.3% of all medication orders, while et al. (2010) identified a 6% transcribing error rate in pediatric and intensive care units (Campino Villegas et al., 2006; Rivas R et al., 2010). The variation reflects the impact of factors like healthcare protocols, error-reporting practices, and

levels of staff training on transcribing error rates.

Common Types of Transcribing Errors

Transcribing errors commonly include omissions and incorrect entries, both of which pose significant risks. Key types of transcribing errors identified in the literature are:

- Omission errors: These include missing critical information such as dosage, route, or timing, which can lead to under-treatment or ineffective dosing.
- Incorrect dose entries: Particularly dangerous in pediatric and neonatal care, where dosages must be precise to avoid adverse effects.
- Incorrect units or intervals: Studies highlight instances where miswritten units or frequencies have led to serious patient outcomes, indicating the importance of accuracy in all transcribed entries.

These specific error types have led to calls for standardized transcription protocols, especially in high-risk settings where high-alert medications are prescribed.

Contributing Factors and Contextual Challenges

Several systemic factors increase the risk of transcribing errors. Studies show that environmental stressors such as poor lighting, heavy workloads, frequent interruptions, and inadequate staff training are significant contributors to errors. Interruptions have been shown to break focus, thereby increasing the risk of incorrect transcription for complex medication regimens (Frush et al., 2004).

Additionally, the absence of standardized procedures for transcribing medication orders exacerbates the issue. Narula et al. (2010) noted that transcribing errors, including those related to incorrect patient identification and dose inaccuracy, were more prevalent in settings where minimal guidance was provided on preventing such error(Narula et al., 2010).

Strategies for Reducing Transcribing Errors

Efforts to minimize transcribing errors have led to recommendations and interventions that target both system-wide and individual practices. Key strategies include:

1. Enhanced training: Healthcare providers, particularly those in pediatric and neonatal care, should receive focused training on accurate transcription methods.
2. Standardized checklists: Checklists that ensure all necessary information is transcribed accurately and completely have been shown to reduce omission and accuracy errors.
3. Electronic Health Records (EHRs): Integrated EHR systems that cross-check patient-specific factors like dosage, route, and timing reduce the incidence of transcribing errors through real-time alerts.
4. Non-punitive reporting systems: Encouraging error reporting without fear of punitive action fosters a transparent environment where staff can report errors, aiding in the identification and prevention of transcribing issues. Studies in both the

U.S. and the U.K. show that incident reporting systems are crucial for understanding and addressing transcribing errors.

Transcribing errors remain a significant risk factor in medication safety, particularly in settings that demand precision, such as pediatric and neonatal units. Variations in error rates across studies suggest that different detection methods may capture transcribing errors to varying degrees, indicating a need for comprehensive, standardized protocols. Effective training, adoption of error-prevention technology, and fostering a non-punitive reporting culture are essential in addressing transcribing errors and enhancing patient safety. Continued research and the application of these strategies are crucial for mitigating the risks associated with transcribing errors across diverse healthcare environments.

Monitoring of Medications and Patients

Monitoring errors in medication management are defined as “failures to review a prescribed regimen for appropriateness and detection of problems, or failure to use appropriate clinical or laboratory data for adequate assessment of patient response to prescribed therapy” (M. A. Ghaleb et al., 2010). Effective monitoring is essential to avoid adverse drug events (ADEs), particularly in high-risk settings such as pediatric and neonatal care, where patients are more vulnerable due to individualized dosing requirements and immature physiological responses.

Frequency and Scope of Monitoring Errors

The frequency of monitoring errors varies based on healthcare settings and detection methods. In one study at a U.S. specialist children’s hospital, monitoring errors represented 62.5% of all identified medication errors, emphasizing the importance of continuous assessment for effective treatment (M. A. Ghaleb et al., 2010). Different data collection methods also reveal inconsistencies in detection. For instance, incident reports in another U.S. study found monitoring errors to be relatively low, accounting for 0.6% in chemotherapy and 1.4% in neonatal cases, suggesting that certain methods may underrepresent these errors (Jones, 2009). Chart reviews often detect more monitoring errors than incident reporting systems, which depend on voluntary submissions and may lead to underreporting (Flynn et al., 2002).

In international contexts, monitoring error rates also vary due to differences in healthcare protocols, error-reporting practices, and levels of staff training. Studies have demonstrated that failure to monitor patient responses and laboratory results, especially in intensive care units, can lead to continued administration of inappropriate doses, which poses significant risks in pediatric care.

Common Types of Monitoring Errors

Common monitoring errors include omission of necessary follow-up assessments, failure to act on abnormal laboratory results, and neglect in adjusting medication based on specific patient factors. For instance, pediatric patients often require close monitoring to adjust doses according to weight and changing metabolic rates. Monitoring failures, such as missed lab checks or failure to reassess dosage, can lead to serious consequences, especially with high-risk medications like chemotherapeutic

agents and antibiotics, which require precise dosing adjustments to avoid toxicity (Basco et al., 2010). The heightened risk of harm with certain medications has led to recommendations for strict protocols, particularly for drugs with narrow therapeutic indexes (Kozer, Scolnik, Macpherson, et al., 2002).

Contributing Factors and Contextual Challenges

Several systemic and environmental factors contribute to monitoring errors. High workloads, complex medication regimens, and communication gaps among healthcare providers can significantly impact effective monitoring practices. Studies indicate that healthcare settings with frequent interruptions, high patient turnover, and limited staff resources tend to see higher rates of monitoring errors, particularly in environments like neonatal intensive care units (Taylor et al., 2007). Additionally, insufficient standardized protocols for monitoring can lead to inconsistencies, making it more challenging to maintain high standards of care.

Institutional variability in the use of technology, such as electronic health records (EHRs) and Clinical Decision Support Systems (CDSS), also affects monitoring accuracy. For example, systems with automated alerts for abnormal results can improve response times and reduce monitoring errors, whereas facilities lacking such systems may rely on manual checks, increasing the likelihood of oversight (Fortescue et al., 2003). However, some challenges persist, as even advanced EHR systems may not capture all patient-specific factors, such as concurrent therapies and unique metabolic responses in pediatric patients (Kadmon et al., 2009).

Strategies for Improving Monitoring of Medications

Efforts to reduce monitoring errors have led to several strategic recommendations, aimed at both healthcare providers and healthcare institutions:

1. Implementation of Standardized Protocols: Establishing strict guidelines for monitoring high-risk medications helps ensure consistency and thoroughness in monitoring. Standard protocols can outline frequency and methods for checking medication levels, patient responses, and relevant lab results.

2. Enhanced Use of Technology: Integrating EHRs with CDSS features that issue real-time alerts for abnormal results and recommended follow-up actions can significantly reduce monitoring errors by drawing immediate attention to critical patient data.

3. Encouragement of Non-Punitive Reporting Systems: Creating non-punitive, anonymous reporting systems can encourage healthcare providers to report monitoring errors. By fostering a culture of safety rather than blame, staff are more likely to share experiences that highlight gaps in current practices, which can then be addressed through policy adjustments.

4. Ongoing Training and Education: Healthcare providers benefit from regular training on monitoring practices, especially regarding high-risk medications. Updated training programs can reinforce the importance of consistent monitoring, familiarize staff with new technologies, and ensure staff remain aware of evolving best practices in patient safety.

5. Improved Communication and Collaboration: Effective communication within multidisciplinary teams is essential to avoid monitoring errors. Regular discussions about patient progress, monitoring requirements, and any significant lab findings allow for timely intervention and correction of potential medication-related issues.

6. Specialized Monitoring in Pediatric and High-Risk Units: Monitoring protocols tailored specifically for high-risk environments, such as neonatal and pediatric intensive care units, can address unique patient needs, such as close observation of medication effects, patient symptoms, and lab data adjustments for growth and developmental changes.

Monitoring medications and patients is a vital component of safe medication management and is particularly important in pediatric and intensive care settings. The variability in error rates across studies and detection methods indicates a need for comprehensive and standardized monitoring practices. Implementing strict protocols, leveraging technology, fostering a non-punitive culture, and promoting continuous education are essential for reducing monitoring errors and improving patient outcomes. Healthcare institutions that prioritize these measures are better positioned to ensure safe, effective treatment and minimize risks associated with monitoring failures.

Role of the pharmacist

Clinical pharmacists are the most trustworthy people to ask about medications in hospitals. To improve patient outcomes and prevent MEs, they are educated to create the optimal treatment plan for each patient (Pak et al., 2015). Working closely with doctors and communicating with other medical staff in hospital wards while prescribing medications, calculating dosages, preparing and administering them, and identifying, reporting, and preventing MEs are all crucial aspects of a clinical pharmacist's job. Direct observation and monitoring of the patient's prescription medications is another aspect of the clinical pharmacist's job to make sure they are being used appropriately (Dalton & Byrne, 2017). By identifying MEs through a reporting system and analyzing the data, the healthcare system can improve patient safety by modifying its protocols and rebuilding a safer system (Pietra et al., 2005).

Pharmacists' understanding of medication management, drug interactions, and dosage modifications is crucial in ensuring that patients receive the correct medication at the appropriate dose and time. Furthermore, pharmacists can play an important role in teaching patients and their families on the safe and effective use of medications, including potential adverse effects and drug interactions (Billstein-Leber et al., 2018; Medicine & America, 2000).

Clinical pharmacists are involved before, during and after writing the prescription. Before prescriptions are written; clinical pharmacists’ roles include the decision of which products should be purchased, which medications should be included in hospital formularies and which management guidelines should be implemented. During prescription writing, their role involves advising doctors around the best medications and dose regimen to use including cost. After writing prescriptions, they

ensure the suitability and accuracy of medications prescribed and monitoring process are in place (Barber, 1996).

Clinical pharmacists are a primary source for providing information and advice, based on scientific evidence, to ensure delivery of the correct, safest and most effective medication to patients (American College of Clinical Pharmacy, 2008). In order for them to work effectively they need to have a good background knowledge about diseases, therapeutics, medications and their mechanism of actions, drug monitoring, good therapeutic planning skills, the ability to do a risk assessment and interpret their findings, the effect of the body on drugs and the effect of drugs on the body, adverse drug events, the economic and effective impact of using some medications over others and good communication skills (Scroccaro et al., 2000).

The following are some of the tasks and responsibilities of pharmacists in hospitals.

1. Medication Management: Pharmacists manage and dispense medications to patients. They ensure that the correct drug is administered to the correct patient at the appropriate time and dose. They also inform patients about how to take their medication and any possible negative effects.

2. Drug Information: Pharmacists are an invaluable resource for healthcare workers since they provide information about medications, doses, interactions, and side effects. They give information to doctors, nurses, and other healthcare professionals, ensuring that patients receive appropriate and safe pharmaceutical therapy.

3. medication Safety: Pharmacists oversee assuring drug safety in hospitals. They monitor prescription orders to avoid dose errors, drug interactions, and contraindications. They also collaborate with healthcare providers to decrease prescription errors and bad drug responses.

4. Patient Education: Pharmacists perform a critical role in informing patients about their medications. They explain how to take drugs, what to expect, and any adverse effects. They also answer any inquiries patients may have concerning about their prescription regimen.

5. Clinical Pharmacy Services: By collaborating with medical teams to recommend medication therapy tailored to each patient, pharmacists offer clinical pharmacy services in hospitals. Additionally, they monitor drug therapy, take part in medication management rounds, and handle medication-related issues.

6. Prescription handling - To guarantee safe and efficient drug therapy, hospital pharmacists have a crucial duty to handle prescriptions through the following:

1. Verification and Accuracy: To make sure that the medication is suitable for the patient's age, medical condition, and other elements like allergies or drug interactions, pharmacists must confirm the prescription's completeness and accuracy.

2. Dosage and delivery: Before giving patients medication, pharmacists must verify the medication's dosage, strength, and delivery method.

3. Documentation and Communication: Pharmacists speak with the physician

to address any differences that may occur during prescription processing and to clarify any unclear information. To preserve patient safety and provide continuity of care, they also precisely record prescription information.

4. Importance in medication management: Pharmacists are essential to maintaining safe and efficient pharmaceutical therapy, and prescription processing is a crucial part of medication administration in hospitals.

2. Conclusion

Medication errors are a pervasive issue that significantly impacts patient safety, particularly within pediatric and hospital settings. These errors can occur at various stages of therapeutic management, from prescribing to monitoring, and they often stem from a combination of personal, environmental, and systemic factors. Strategies such as clear communication, technology integration, and fostering a culture of non-punitive error reporting are essential in minimizing these risks. Pharmacists play a critical role in preventing medication errors, providing expertise and support in medication management, patient education, and safety monitoring. By implementing targeted strategies and leveraging the expertise of pharmacists, healthcare systems can reduce the incidence of medication errors and enhance patient outcomes.

References

Al-Worafi, Y. (2018). Dispensing errors observed by community pharmacy dispensers in ibb-yemen. Asian Journal of Pharmaceutical and Clinical Research, 11, 478–481. https://doi.org/10.22159/ajpcr.2018.v11i11.28382

American College of Clinical Pharmacy. (2008). The definition of clinical pharmacy. Pharmacotherapy, 28(6), 816–817. https://doi.org/10.1592/phco.28.6.816

Avery, T. (2003). Medication Errors: Lessons for Education and Healthcare. BMJ : British Medical Journal, 326(7388), 555.

Barber, N. (1996). TOWARDS A PHILOSOPHY OF CLINICAL PHARMACY. The Pharmaceutical Journal. https://www.semanticscholar.org/paper/TOWARDS-A-PHILOSOPHY-OF-CLINICAL-PHARMACY-Barber/ccd5685c66634758f3e9d2a0af362934e69b6ea6

Basco, W. T., Ebeling, M., Hulsey, T. C., & Simpson, K. (2010). Using pharmacy data to screen for look-alike, sound-alike substitution errors in pediatric prescriptions. Academic Pediatrics, 10(4), 233–237. https://doi.org/10.1016/j.acap.2010.04.024

Billstein-Leber, M., Carrillo, C. J. D., Cassano, A. T., Moline, K., & Robertson, J. J. (2018). ASHP Guidelines on Preventing Medication Errors in Hospitals. American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists, 75(19), 1493–1517. https://doi.org/10.2146/ajhp170811

Campino Villegas, A., López Herrera, M., García Franco, M., López de Heredia y Goya, I., & Valls i Soler, A. (2006). Errores en la prescripción y transcripción de medicación en una unidad neonatal. Anales de Pediatría, 64(4), 330–335. https://doi.org/10.1157/13086520

Costa, L. A., Valli, C., & Alvarenga, A. P. (2008). Medication dispensing errors at a public pediatric hospital. Revista Latino-Americana De Enfermagem, 16(5), 812–817. https://doi.org/10.1590/s0104-11692008000500003

Dalton, K., & Byrne, S. (2017). Role of the pharmacist in reducing healthcare costs: Current insights. Integrated Pharmacy Research & Practice, 6, 37–46.

https://doi.org/10.2147/IPRP.S108047

Dornan, T., Ashcroft, D., Heathfield, H., Lewis, P., Miles, J., Taylor, D., Tully, M., & Wass, V. (2009). An in-depth investigation into causes of prescribing errors by foundation trainees in relation to thier medical education: EQUIP study. https://research.manchester.ac.uk/en/publications/an-in-depth-investigation-into-causes-of-prescribing-errors-by-fo

Elliott, R. A., Camacho, E., Jankovic, D., Sculpher, M. J., & Faria, R. (2021). Economic analysis of the prevalence and clinical and economic burden of medication error in England. BMJ Quality & Safety, 30(2), 96–105. https://doi.org/10.1136/bmjqs-2019-010206

Engum, S. A., & Breckler, F. D. (2008). An evaluation of medication errors-the pediatric surgical service experience. Journal of Pediatric Surgery, 43(2), 348–352. https://doi.org/10.1016/j.jpedsurg.2007.10.042

Ferner, R. E., & Aronson, J. K. (2006). Clarification of terminology in medication errors: Definitions and classification. Drug Safety, 29(11), 1011–1022. https://doi.org/10.2165/00002018-200629110-00001

Flynn, E. A., Barker, K. N., Pepper, G. A., Bates, D. W., & Mikeal, R. L. (2002). Comparison of methods for detecting medication errors in 36 hospitals and skilled-nursing facilities. American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists, 59(5), 436–446. https://doi.org/10.1093/ajhp/59.5.436

Fortescue, E. B., Kaushal, R., Landrigan, C. P., McKenna, K. J., Clapp, M. D., Federico, F., Goldmann, D. A., & Bates, D. W. (2003). Prioritizing strategies for preventing medication errors and adverse drug events in pediatric inpatients. Pediatrics, 111(4 Pt 1), 722–729. https://doi.org/10.1542/peds.111.4.722

Frush, K. S., Luo, X., Hutchinson, P., & Higgins, J. N. (2004). Evaluation of a method to reduce over-the-counter medication dosing error. Archives of Pediatrics & Adolescent Medicine, 158(7), 620–624. https://doi.org/10.1001/archpedi.158.7.620

Ghaleb, M. (2006). Medication errors in paediatric patients. Archives of Disease in Childhood-Education and Practice Edition - ARCH DIS CHILDHOOD-EDUC PRACT, 91. https://doi.org/10.1136/adc.2005.073379

Ghaleb, M. A., Barber, N., Dean Franklin, B., & Wong, I. C. K. (2005). What constitutes a prescribing error in paediatrics? Quality & Safety in Health Care, 14(5), 352–357. https://doi.org/10.1136/qshc.2005.013797

Ghaleb, M. A., Barber, N., Franklin, B. D., & Wong, I. C. K. (2010). The incidence and nature of prescribing and medication administration errors in paediatric inpatients. Archives of Disease in Childhood, 95(2), 113–118. https://doi.org/10.1136/adc.2009.158485

Ghaleb, M. A., Barber, N., Franklin, B. D., Yeung, V. W. S., Khaki, Z. F., & Wong, I. C. K. (2006). Systematic review of medication errors in pediatric patients. The Annals of Pharmacotherapy, 40(10), 1766–1776. https://doi.org/10.1345/aph.1G717

Gupta, Y., Kumar, N., Shukla, A., & Rai, V. (2023). Assessment of the Role of Pharmacists in Preventing Medication Errors in Hospital Settings. Journal for Research in Applied Sciences and Biotechnology, 2(2), Article 2. https://doi.org/10.55544/jrasb.2.2.30

Han, W. H., & Maxwell, S. R. J. (2006). Are medical students adequately trained to prescribe at the point of graduation? Views of first year foundation doctors. Scottish Medical Journal, 51(4), 27–32. https://doi.org/10.1258/RSMSMJ.51.4.27

Hicks, R. W., Sikirica, V., Nelson, W., Schein, J. R., & Cousins, D. D. (2008). Medication errors involving patient-controlled analgesia. American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists, 65(5), 429–440. https://doi.org/10.2146/ajhp070194

James, K. L., Barlow, D., McArtney, R., Hiom, S., Roberts, D., & Whittlesea, C. (2009). Incidence, type and causes of dispensing errors: A review of the literature. The

International Journal of Pharmacy Practice, 17(1), 9–30.

Jones, S. W. (2009). Reducing medication administration errors in nursing practice. Nursing Standard (Royal College of Nursing (Great Britain): 1987), 23(50), 40–46. https://doi.org/10.7748/ns2009.08.23.50.40.c7213

Kadmon, G., Bron-Harlev, E., Nahum, E., Schiller, O., Haski, G., & Shonfeld, T. (2009). Computerized order entry with limited decision support to prevent prescription errors in a PICU. Pediatrics, 124(3), 935–940. https://doi.org/10.1542/peds.2008-2737

Kaushal, R., Bates, D. W., Landrigan, C., McKenna, K. J., Clapp, M. D., Federico, F., & Goldmann, D. A. (2001). Medication errors and adverse drug events in pediatric inpatients. JAMA, 285(16), 2114–2120. https://doi.org/10.1001/jama.285.16.2114

Kaushal, R., Jaggi, T., Walsh, K., Fortescue, E. B., & Bates, D. W. (2004). Pediatric medication errors: What do we know? What gaps remain? Ambulatory Pediatrics: The Official Journal of the Ambulatory Pediatric Association, 4(1), 73–81. https://doi.org/10.1367/1539-4409(2004)004<0073:pmewdw>2.0.co;2

Khowaja, K., Nizar, R., Merchant, R. J., Dias, J., Bustamante-Gavino, I., & Malik, A. (2008). A systematic approach of tracking and reporting medication errors at a tertiary care university hospital, Karachi, Pakistan. Therapeutics and Clinical Risk Management, 4(4), 673–679. https://doi.org/10.2147/tcrm.s2646

Kozer, E., Scolnik, D., Keays, T., Shi, K., Luk, T., & Koren, G. (2002). Large errors in the dosing of medications for children. The New England Journal of Medicine, 346(15), 1175–1176. https://doi.org/10.1056/NEJM200204113461518

Kozer, E., Scolnik, D., Macpherson, A., Keays, T., Shi, K., Luk, T., & Koren, G. (2002). Variables associated with medication errors in pediatric emergency medicine. Pediatrics, 110(4), 737–742. https://doi.org/10.1542/peds.110.4.737

Lehmann, C. U., & Kim, G. R. (2005). Prevention of medication errors. Clinics in Perinatology, 32(1), 107–123, vii. https://doi.org/10.1016/j.clp.2004.10.003

Medicine, I. of, & America, C. on Q. of H. C. in. (2000). To Err Is Human: Building a Safer Health System. National Academies Press.

Nair, R. P., Kappil, D., & Woods, T. M. (2010). 10 strategies for minimizing dispensing errors. Pharmacy Times, 76.

Narula, P., Hartigan, D., & Puntis, J. W. L. (2010). Frequency and significance of errors related to parenteral nutrition in children. Proceedings of the Nutrition Society, 69(OCE7), E556. https://doi.org/10.1017/S0029665110004258

National Coordinating Council for Medication Error Reporting and Prevention | NCC MERP. (n.d.). Retrieved November 8, 2024, from https://www.nccmerp.org/

Neelakantan, M., Sharma, P., & Kulkarni, A. (2024). Look-alike, sound-alike (LASA) drugs in India. The Lancet Regional Health - Southeast Asia, 26. https://doi.org/10.1016/j.lansea.2024.100425

Pak, A., Sahibzada, M., Afridi, R., Khan, T., Wahab, A., Kalsoom, U., Kifayat, U., Khan, F., & Ahmad, W. (2015). Medication Errors Assessment and Prevention by a Clinical Pharmacist in Pediatric Wards… Umar Khayam et al Medication Errors Assessment and Prevention by a Clinical Pharmacist in Pediatric Wards of RMI Hospital Peshawar, KPK-Pakistan Address for Correspondence. 11, 124–129.

Patanwala, A. E., Warholak, T. L., Sanders, A. B., & Erstad, B. L. (2010). A prospective observational study of medication errors in a tertiary care emergency department. Annals of Emergency Medicine, 55(6), 522–526. https://doi.org/10.1016/j.annemergmed.2009.12.017

Patient safety solution: Look-alike, sound-alike medication names. (n.d.). Retrieved November 8, 2024, from https://www.who.int/publications/m/item/patient-safety-solution-look-alike-sound-alike-medication-names

Pham, J. C., Story, J. L., Hicks, R. W., Shore, A. D., Morlock, L. L., Cheung, D. S., Kelen, G.

D., & Pronovost, P. J. (2011). National study on the frequency, types, causes, and consequences of voluntarily reported emergency department medication errors. The Journal of Emergency Medicine, 40(5), 485–492. https://doi.org/10.1016/j.jemermed.2008.02.059

Pietra, L. L., Calligaris, L., Molendini, L., Quattrin, R., & Brusaferro, S. (2005). Medical errors and clinical risk management: State of the art. Acta Otorhinolaryngologica Italica, 25(6), 339.

Rivas R, E., Rivas L, A., & Bustos M, L. (2010). Errores en prescripción y transcripción de medicamentos endovenosos en Servicios Pediátricos, Hospital Dr. Hernán Henríquez Aravena: Temuco, 2008-2009. Revista Médica de Chile, 138(12), 1524–1529. https://doi.org/10.4067/S0034-98872010001300008

Scroccaro, G., Almiñana, M. A., Floor-Schreudering, A., Hekster, Y. A., & Huon, Y. (2000). The need for clinical pharmacy. Pharmacy World & Science: PWS, 22(1), 27–29. https://doi.org/10.1023/a:1008739729849

Sinha, G., Acharya, L. D., Tunga, G., & Mathews, T. (2016). A STUDY OF MEDICATION ERRORS IN GENERAL MEDICINE WARDS OF THE SOUTH INDIAN TERTIARY CARE HOSPITAL. Asian Journal of Pharmaceutical and Clinical Research, 196–200.

Stucky, E. R., American Academy of Pediatrics Committee on Drugs, & American Academy of Pediatrics Committee on Hospital Care. (2003). Prevention of medication errors in the pediatric inpatient setting. Pediatrics, 112(2), 431–436. https://doi.org/10.1542/peds.112.2.431

Takata, G. S., Mason, W., Taketomo, C., Logsdon, T., & Sharek, P. J. (2008). Development, testing, and findings of a pediatric-focused trigger tool to identify medication-related harm in US children's hospitals. Pediatrics, 121(4), e927-935. https://doi.org/10.1542/peds.2007-1779

Taylor, J. A., Brownstein, D., Klein, E. J., & Strandjord, T. P. (2007). Evaluation of an anonymous system to report medical errors in pediatric inpatients. Journal of Hospital Medicine, 2(4), 226–233. https://doi.org/10.1002/jhm.208

The prevalence of adverse drug event-related admissions at a local hospital in Malaysia. (2013). Archives of Pharmacy Practice, 4(4–2013), Article 4–2013.

van den Bemt, P. M. L. A., Robertz, R., de Jong, A. L., van Roon, E. N., & Leufkens, H. G. M. (2007). Drug administration errors in an institution for individuals with intellectual disability: An observational study. Journal of Intellectual Disability Research: JIDR, 51(Pt 7), 528–536. https://doi.org/10.1111/j.1365-2788.2006.00919.x

Walsh, E. K., Hansen, C. R., Sahm, L. J., Kearney, P. M., Doherty, E., & Bradley, C. P. (2017). Economic impact of medication error: A systematic review. Pharmacoepidemiology and Drug Safety, 26(5), 481–497. https://doi.org/10.1002/pds.4188

Wilson, D. G., McArtney, R. G., Newcombe, R. G., McArtney, R. J., Gracie, J., Kirk, C. R., & Stuart, A. G. (1998). Medication errors in paediatric practice: Insights from a continuous quality improvement approach. European Journal of Pediatrics, 157(9), 769–774. https://doi.org/10.1007/s004310050932