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PATIENT SAFETY IN PHARMACOTHERAPY: A REVIEW IN MEDICATION ERRORS AND THEIR PREVENTION

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ABSTRACT

Medication errors are a major public health concern that can result in significant harm to patients. Understanding the different types and causes of medication errors is essential to preventing these incidents.This article reviews the literature on medication errors, their types, causes, and prevention strategies. The review includes studies from various countries and healthcare settings. Medication errors can occur at any stage of the medication use process, from prescription to administration and monitoring. Prescription errors, dispensing errors, administration errors, and monitoring errors are the most common types of medication errors. Factors contributing to medication errors include patient-related factors, healthcare provider- related factors, and system related factors. Clinical pharmacy services have been shown to be effective in preventing medication errors.

INTRODUCTION

In the 1930s, the first ICU was established. Around the same time, Harvey A.K. Whitney started to organise conferences and patient care rounds for trainees in clinical pharmacy practice (who were not known as pharmacy residents). In the 1950s and 1960s, when the first decentralised pharmacy services were introduced, advancements in mechanical ventilators caused a rise in the number of intensive care units (ICUs). By the 1980s, critical care pharmacy practice had spread considerably; the first critical care column had been published in a pharmacy journal; and the Society of Critical Care Medicine (SCCM) had created a section for clinical pharmacists and pharmacologists in order to acknowledge the efforts of pharmacists [1].

The idea of including a clinical pharmacist in a multidisciplinary team led by an intensivist developed in the United States at the beginning of the 1980s. In the 1980s, critical care pharmacists began to specialise in their training and take on more leadership roles in critical care organisations. When a clinical pharmacist is included in an intensive care healthcare team, several prospective, controlled trials show a much-reduced incidence of adverse drug events (ADEs) and fewer days of hospitalisation. Data in the past showed that pharmacist engagement enhanced fluid management, reduced prescription errors, and decreased the occurrence of adverse drug reactions (ADRs).

Over the past 25 years, the specialty of critical care pharmacy practice has developed into a vital part of the multidisciplinary team in the intensive care unit (ICU). There is evidence that critical care pharmacist efforts have a significant influence on outcomes and can prevent potentially life-threatening situations. Future pharmacist roles may involve better patient and family communication, involvement in care transitions, driving quality indicator improvement, optimising dosage in specialist populations, and utilising independent prescribing abilities.

1. DEFINITION AND SCOPE OF MEDICATION ERRORS

1.1 Medication Error

While there is no uniform definition of a medication error, the National Coordinating Council for Medica-

tion Error Reporting and Prevention defines a medication error as:

"… any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use " [2].

1.2 Adverse Drug Reaction

The World Health Organization defines an adverse drug reaction as:

"Any response that is noxious, unintended, or undesired, which occurs at doses normally used in humans for prophylaxis, diagnosis, therapy of disease, or modification of physiological function."

Adverse drug reactions are expected negative outcomes inherent to the pharmacologic action of the drug and are not always preventable, while medication errors are preventable [3].

1.3 Adverse Drug Event

An adverse drug event is an injury from a medication or a missed or inappropriately dosed medication. An adverse drug event causes morbidity or mortality to a patient. The difference between an adverse drug reaction and an adverse drug event is that in an adverse drug event, the patient must be exposed to a medication with a negative consequence, which may or may not be expected.

For adverse drug events, the patient suffers a negative consequence from receiving a drug in the usual manner it was intended, not receiving a required medication, or receiving a medication in an inappropriate manner such as too high or too low a dose [4].

1.4 Medication Misadventure

A medication misadventure is an iatrogenic incident that is inherent to medication therapy. Medication misadventure includes medication errors, adverse drug reactions, and adverse drug events. It is created through omission or commission of medication administration. Medication misadventures are always undesirable and unexpected; they may or may not be independent of preexisting pathology and might be due to human or system error, idiosyncratic, or immunologic response.

1.5 Sentinel Event

The Joint Commission defines a sentinel event as:

"An unexpected occurrence involving death, serious physical or psychological injury, or the risk thereof. Serious injury specifically includes loss of limb or function or serious adverse outcomes."

Sentinel events may include medication errors and adverse drug events.

SCOPE OF MEDICATION ERRORS

Medication errors are a significant concern in healthcare, affecting patient safety and treatment outcomes. They can occur at any stage of the medication use process: prescribing, transcribing, dispensing, administering, and monitoring.

These errors can occur in various healthcare settings (hospitals, clinics, community pharmacies, home care) and involve different healthcare professionals (doctors, nurses, pharmacists, and patients). The scope includes potential impact on patient safety, treatment outcomes, healthcare costs, and legal implications.

2. TYPES OF MEDICATION ERRORS

1. Prescription error:

A prescription error can be defined as a set of planned acts that may not produce the expected result because actions did not go as planned or because the plan was insufficient. Prescribing error is a common drug error that can be prevented in hospitals worldwide.

Types of prescription errors include incorrect route, dose, frequency, dosage form, quantity to supply, and omission errors related to the prescriber (including patient name, age, prescriber name, prescriber signature, department, and diagnosis), as well as commission errors (including wrong strength, incorrect drug name, incorrect dosage form, and drug–drug interactions) [5].

2. Dispensing error

Dispensing errors are any inconsistencies between the written instructions on the prescription order form and the medication supplied by the pharmacy. Hospital units use a variety of medication dispensing systems, each with different error risks.

Common dispensing errors include missing doses, omissions, inaccurate patient or medicine names, and incorrect labeling. Failure to verify patient identity is a common cause. Occasionally, incorrect patient details may be entered into pharmacy databases [6].

3. Administration error:

A medication administration error occurs when a patient receives a medication different from what the prescriber intended. This can occur at any stage of the medication process. Medication errors can have serious consequences, including patient harm, increased hospital stay, and even death. Omissions, where a prescribed medication is not given, are common administration errors [7].

4. Monitoring error:

A monitoring error occurs when a prescribed medicine is not monitored according to the accepted standard of care. This includes failure to perform required tests at appropriate intervals. If a patient refuses testing, it is not considered an error [8].

3. CAUSES OF MEDICATION ERRORS

- **Expired product:** Occurs due to improper storage or use of expired medications.
- **Incorrect duration:** Medication is given for longer or shorter than prescribed.
- **Incorrect preparation:** Errors in compounding or reconstitution, such as using the wrong diluent.
- **Incorrect strength:** Occurs due to selection of wrong dosage strength or labeling errors [9-10].

4. ROLE OF PHARMACIST IN MEDICATION ERRORS AND ADR PREVENTION

Clinical pharmacists play an important role in reducing medication errors and adverse drug reactions. Their interventions improve prescribing quality, enhance patient safety, and reduce healthcare costs.

Pharmacists contribute through medication review, identifying drug interactions, dose optimization, and participation in multidisciplinary teams. They are essential in ensuring safe prescribing, dispensing, and monitoring of medications.

They also play a key role in patient education, medication reconciliation, and transition of care. Overall, pharmacist involvement significantly reduces medication errors and improves patient outcomes [11-12].

5. STRATEGIES TO REDUCE MEDICATION ERRORS

- Double-check dosing and frequency of high-alert medications.
- Consult a pharmacist when uncertain about a drug or dose.
- Do not administer if prescriptions are illegible; verify with prescriber.
- Recheck dosage calculations and involve another clinician if needed [13-14].

PREVENTING MEDICATION ERRORS

- Write one prescription per medication.
- Avoid abbreviations in prescriptions.
- Include patient age and weight.
- Specify dose, route, frequency, and duration clearly.
- Check liver and renal function before prescribing.
- Identify high-risk medications.
- Document indication for each medication [15].

6. USE OF TECHNOLOGY IN IMPROVING MEDICATION SAFETY

Medication errors remain a major healthcare challenge. Technology significantly improves safety by reducing human error and enhancing communication.

Key technologies include:

- Computerized Provider Order Entry (CPOE)
- Clinical Decision Support Systems (CDSS)
- Barcode Medication Administration (BCMA)
- Automated Dispensing Cabinets (ADCs)

These systems provide real-time alerts for allergies, drug interactions, and dosing errors. Artificial intelligence and smart systems further improve prescribing, dispensing, and administration accuracy [16].

7. FUTURE DIRECTIONS FOR PHARMACIST INVOLVEMENT IN PATIENT CARE

Pharmacists play an expanding role in patient care, including clinical practice, counseling, education, and community services [17].

They are increasingly involved in transitions of care, medication reconciliation after hospital discharge, and patient education. These interventions reduce readmissions, adverse events, and mortality [18-19.

Pharmacists are also essential in antimicrobial stewardship and quality improvement programs. With advancements in healthcare technology, their role continues to expand toward longitudinal patient care and improved patient safety [20].

8. CONCLUSION

Medication errors are preventable events that may lead to inappropriate medication use or patient harm. They can occur at any stage of the medication-use process and significantly impact patient safety and healthcare outcomes. The main types include prescribing, dispensing, administration, and monitoring errors. Multiple factors such as system failures, communication gaps, and human error contribute to these events. Clinical pharmacists play a crucial role in preventing medication errors and improving patient safety. Through multidisciplinary collaboration and the use of modern technology, medication errors can be reduced, leading to improved quality of healthcare delivery.

9. AUTHOR CONTRIBUTIONS

All authors are contributed equally.

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The authors have no conflicts of interest to declare.

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