

Research Article

Assessment of Medication Errors in a Healthcare Setting: A Prescription Audit Study

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DOI: <https://doi.org/10.24321/2278.2044.202457>

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How to cite this article:

Rakholiya R, Shaikh S, Chaniyara H, Bhalodiya P, Mavani V, Nayak S P S, Chakraborty G S, Vagasiya J, Buddhadev M. Assessment of Medication Errors in a Healthcare Setting: A Prescription Audit Study. Chettinad Health City Med J. 2024;13(4):34-42.

Date of Submission: 2024-03-09

Date of Acceptance: 2024-09-02

A B S T R A C T

Introduction: Prescription auditing is crucial for evaluating healthcare quality and optimizing medication usage. Medication errors can occur during prescribing, dispensing, and administration, impacting patient safety. This study aims to assess medication errors across these stages, focusing on prescribing practices using WHO core prescribing indicators.

Method: A total of 350 prescriptions were audited to identify errors in prescribing, dispensing, and administration. Prescribing errors were assessed using WHO's core indicators, while dispensing and administration errors were identified through a review of the prescription process. Errors were categorized into dosage inaccuracies, abbreviation misuse, and documentation lapses for prescribing, and drug dispersion and labelling issues for dispensing.

Results: The audit identified 151 prescribing errors, 9 dispensing errors, and 24 administration errors. Major prescribing errors included dosage inaccuracies, abbreviation misuse, and documentation lapses. Dispensing errors were fewer, focusing on incorrect drug dispersion and labelling. Administration errors involved dose omissions and documentation issues.

Conclusion: The findings underscore the importance of implementing robust quality assurance measures to reduce medication errors at all stages of the medication use process. Enhanced healthcare provider training, particularly in prescribing practices, is essential to mitigate medication-related risks and improve patient safety. The results of this study highlight the need for ongoing monitoring and improvements in healthcare systems to minimize the occurrence of medication errors and enhance the overall quality of care.

Keywords: Prescription Audit, Drug Utilisation Research, WHO Prescribing Indicators, Prescription Error, Clinical Pharmacist, Health-Related Quality of Life

Introduction

The core prescribing indicators of the World Health Organization (WHO) are extremely standardised instruments that are capable of accurately evaluating the key components of drug usage patterns.¹ A Prescription Audit (PA) is defined as “the review and evaluation of health-care procedures and their documentation to compare the quality of care which are being provided, with the accepted set standards”.²⁻⁴ The World Health Organization (WHO) defines drug utilisation research as the study of the marketing, distribution, prescription, and use of drugs in society, emphasising the resulting medical, social, and economic consequences.^{5,6} The goal of drug utilisation research and audits is to improve drug usage patterns and enhance patient care.

Medication Errors and Their Consequences

Medication error is “any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in control of the health care professional, patient, or consumer”. These are prevalent in hospitals and are a major global cause of preventable mortality.⁷ They include prescription, transcription, dispensing, and administration errors.⁷ The impact of these errors is significant, causing increased hospital stays, higher mortality rates, and substantial healthcare costs.^{8,9}

Error Rates

- **India:** 7.6%–44%⁷
- **US:** Prescription errors account for 0.4%–15.4%⁷
- **UK:** 7.4%–18.7%³
- **Australia:** 16.6% of admissions involved adverse events, in which, leaving 13.7% of patients permanently disabled and 4.9% dead. 51% of adverse events were deemed avoidable.¹⁰

Roughly 30% of issues that arise during hospital stays are associated with pharmaceutical mistakes. Errors with medications can lead to higher expenses, longer hospital stays, or even potentially fatal consequences. Therefore, it’s critical to recognise, categorise, and analyse medication errors and to put the right measures in place to reduce them.¹¹

The world’s third-largest producer of generic medications is India. Patient compliance is increased by making additional drug choices from the National List of Essential Medicines (NLEM), which is based on sufficient data on cost-effectiveness, safety, and efficacy.^{1,5}

Irrational prescriptions can result in poor care, which puts the patient at risk for increased costs, unwarranted side effects, unneeded mental suffering, and sickness extension or worsening. The WHO develops a set of “core prescribing indicators” with the goal of enhancing patient practices that involve rational drug use.^{2,4}

Rational Drug Use and Prescribing Indicators

- **Rational Drug Use:** Defined by WHO as providing medications appropriate to clinical needs, at the lowest possible cost, for an adequate duration, and in correct doses. Indicators: that meet physiological and pharmacological requirements.^{3,12} Irrational prescribing can lead to increased morbidity, resource waste, and adverse outcomes.¹³
- **Core Prescribing Indicators:** The prescription indicators are primarily used to evaluate how well medical practitioners perform in terms of prescribing medications appropriately.^{14,15} As PA offers documentary evidence, it can be used to assess the quality of medical care provided.² Medications are essential to the provision of healthcare services worldwide. The right use of medications can significantly lower morbidity and mortality rates worldwide.¹⁴

Ideal Prescription Components

- Patient details (name, age, address, hospital registration number)
- Date of prescription
- Clinical diagnosis
- Medication details (generic name, dosage, frequency, quantity)
- Prescribing physician’s information (signature, registration number)^{2,4,13}

Nonetheless, according to data from the WHO, almost 50% of medications are sold, distributed, or prescribed improperly.^{7,16} Prescription errors are prevalent and can impact anywhere from 4.2 to 82% of prescriptions, according to newly available data. Such mistakes may lead to unfavourable outcomes, risky medical interventions, increased treatment expenses, ineffective resource usage, and illogical medication use. Approximately 4 out of every 1000 prescriptions contain mistakes that could have negative consequences. Research has indicated that 56% of these avoidable adverse occurrences happened during the medication ordering process. Both systemic and individual variables can lead to prescription errors. The first vital step in creating safer systems and averting unfavourable occurrences is detecting such faults.^{4,16} Given that between 25 to 70% of global healthcare spending is allocated to medications, this could have an impact on spending on healthcare budgets. Therefore, it is believed that changing how people utilise medications will help to maximise the use of the little resources available to the medical field while simultaneously raising the standard of care provided to patients.^{14,17}

Prescription Audit Process

- **Prescription Audit (PA):** A continuous process that aims to raise the standard of medical care by

analysing prescription practices and identifying areas for improvement.^{2,10}

Benefits

- Enhance quality and professionalism
- Promote staff training and development
- Identify and eliminate substandard practices
- Improve documentation and presentation of results^{3,15,17,18}

Prescription Audit Process Flow chart

Figure 1 shows that a prescription audit is a cyclical process that involves reviewing and improving a facility's prescription practices. It's a quality improvement activity that can help ensure patients receive high-quality care. The steps in a prescription audit include:

Collect and review data, review the prescription and drug chart for each drug, including the drug name, strength, dose, and more, identify and categorize errors, look for errors in the prescription, such as writing the wrong prescription, prescribing the wrong dosage, or prescribing the wrong frequency, analyse patterns and causes then identify patterns and causes of errors and implement changes and improvements and use the findings from the audit to improve prescription practices and patient care.

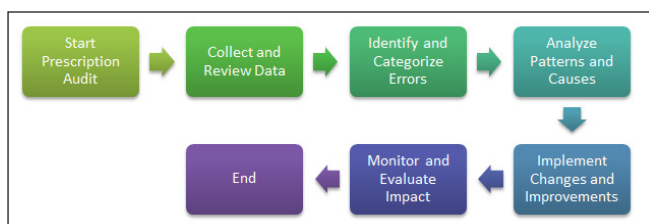


Figure 1. Process of Prescription Audit

Prescription Quality Index (PQI): Developed by Hassan et al. in 2010, it assesses how well drugs are prescribed for chronic conditions through 22 criteria.¹² This tool is versatile and applicable in various settings. The average number of medications prescribed per prescription aids in the researcher's investigation of polypharmacy in the prescription and aids in the prediction of potential Adverse drug reactions (ADRs).^{5,19}

Role of Clinical Pharmacists

Clinical pharmacists contribute by:

- Medication reconciliation
- Drug interaction prevention
- Supporting doctors during ward rounds^{20,21}

Their involvement enhances prescription documentation and overall patient care.¹²

The rise in this certification rate led to a strong push for Clinical Pharmacists (CPs) to be included in healthcare teams as vital healthcare providers in order to promote evidence-based medicine and rational therapy. The pharmacy practice department's provision of pharmaceutical treatment is essential to enhancing the overall delivery of treatment and also provide hospitals with income while ensuring the provision of high-quality care.¹³

Research that emphasises patient care, condenses important ideas, and presents a workable plan for creating, putting into practice, assessing, and maintaining an interdisciplinary quality improvement system is required.²² A complex concept, health-related quality of life (HRQoL) encompasses aspects linked to social, mental, emotional, and physical functioning.^{16,19}

Anti-Microbial Stewardship

Anti-Microbial Stewardship (AMS) refers to "coordinated interventions designed to improve and measure the appropriate use of antimicrobial agents by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy and route of administration".²⁰ This is crucial in combating antibiotic resistance and reducing morbidity and mortality from infectious diseases. Antibiotics will be essential in reducing morbidity and death rates in emerging nations with higher rates of infectious disease. Antibiotic resistance is a global issue that poses a concern. Pneumonia is the leading cause of death for children in India, accounting for an estimated 410,000 fatalities annually as a measure of disease burden.¹³

Misuse, abuse, and underuse of medications are examples of poor prescribing practices that can result in risky treatment, health risks, financial strain on patients, and resource waste. Errors in prescription writing encourage drug abuse and lower patient compliance. These behaviours also raise patient mortality, morbidity, and cost burden by fostering the development of drug interactions, drug resistance, and adverse drug reactions.⁶

According to the current review, in order to encourage rational prescribing, physicians should participate in extensive training programs, educational initiatives, or prescribing awareness campaigns regarding the WHO prescribing indicators. This intervention in healthcare settings may also help to alleviate the problem of overprescribing or irrational drug prescriptions.²³ Prescription audits and feedback combined are recognised to be an effective method for raising the standard of prescribing.²⁴ The degree to which practitioners prescribe from the national essential medicine list is also gauged by WHO measures.²⁵

Prescription audits, rational drug use, and adherence to WHO indicators are vital for improving medication practices and patient outcomes. Proper audits, ongoing training, effective use of resources and adherence to rational drug use principles can mitigate medication errors and enhance the quality of healthcare.

Materials and Methods

Study Design

We selected more than 350 prescriptions from the inpatients department of all wards of the hospital and we audited different parameters based on prescribing, dispensing and administering drugs.

Prescribing Parameters

- No/ wrong dose
- No/ wrong unit
- No/ wrong frequency
- No/ wrong route
- No/ wrong concentration/ dilution
- No/ wrong rate of administration
- Drug allergies not documented
- Non-usage of capital letters for drug names
- Illegible handwriting
- Error-prone abbreviation used
- Non-modification of drug dose keeping in mind drug-drug and food-drug interactions
- Presence of therapeutic duplication

Dispensing Parameters

- Wrong drug dispensed
- Wrong dose dispensed
- Wrong formulation dispensed
- Expired/ near-expiry drug dispensed
- No/ wrong labelling
- Delay in dispense
- Generic or class substitution done without consultation with the prescribing doctors

Administering Parameters

- Wrong patient
- Dose omission
- Improper dose
- Wrong drug
- Wrong dosage form
- Wrong route of administration
- Wrong route
- Wrong duration
- Wrong time
- No documentation of drug administration

Study Duration and Place of Study: 2 month (June 2024 and July 2024) at tertiary care hospital, Ahmedabad, Gujarat

Statistical Tool: Collected data were observed and analysed using Microsoft excel office. The analysed data are presented in tables and graphs.

Informed Consent: This study relied on anonymised data which ensure patient confidentiality and in accordance with institutional and ethical regulation, no hospital approval or patient informed consent was required.

Results

We audited more than 1000 drugs in 350 prescriptions in which we evaluated different parameters related to prescribing, dispensing and administration of drugs. We compared prescription audit parameters with WHO standards based on WHO core prescribing indicators and analysed a total of 184 errors, in which prescribing errors were 151 (82%), Dispensing errors were 9 (4.9%) and Administering errors were 24 (13%).

Analysis of Prescribing Errors

As shown in the Table 1, we found that major prescribing errors were in writing dose, their units, concentration/dilution of some parenteral medications and use of some abbreviation which lead to the medication error. Other than this, we found errors in writing the frequency of drugs, route of drug and not usage of capital letters in drug names. Errors were found associated with interactions between drugs, presence of therapeutic duplication in one prescription, and documentation of the allergy status of patients in prescriptions. A total of 151 prescribing errors were audited from 350 prescriptions. All detected errors are presented in circular chart in Figure 2.

Analysis of Dispensing Errors

As shown in the Table 2, we found fewer errors in dispensing of drugs than in prescribing and administering errors. We analysed dispensing errors in the following criteria: wrong drug dispensed, wrong dose dispensed, labelling not done in dispensed medication and expired or near expired drug dispensed. A total 9 dispensing errors were observed among 350 prescriptions that detected errors are presented in Figure 3.

Analysis of Administration Errors

As shown in the Table 3, we found minor errors in the administration of drugs in the following criteria: dose omission, improper dose of drugs, wrong drugs administered (either wrong dose or wrong combination or wrong formulation), administered drugs with wrong rate or at wrong time duration. The errors also included a few documentation errors by the nursing staff. We found a total of 24 administering errors from 350 prescriptions. All detected errors are presented in circular chart in Figure 4.

Table 1. Prescribing Errors with Criteria and Total Number of Errors Detected

Prescription			
S. No.	Audit Criteria	Total Prescriptions Audited	No. of Errors
1	No/ wrong dose	350	56
2	No/ wrong unit	350	33
3	No/ wrong frequency	350	01
4	No/ wrong route	350	03
5	No/ wrong concentration/ dilution	350	15
6	No/ wrong rate of administration	350	00
7	Drug allergies not documented	350	09
8	Non-usage of capital letters for drug names	350	08
9	Illegible handwriting	350	05
10	Error prone abbreviation used	350	16
11	Non-modification of drug dose keeping in mind drug-drug and food-drug interaction	350	03
12	Presence of therapeutic duplication	350	02

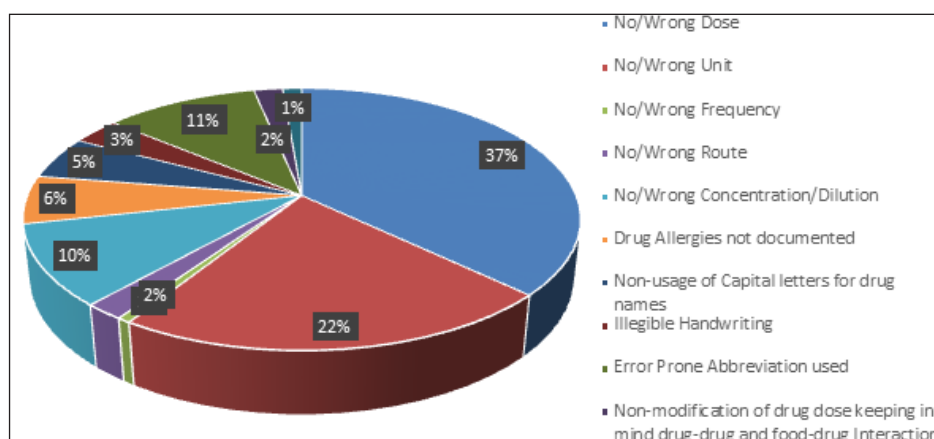


Figure 2. Prescription Errors

Table 2. Dispensing Errors with Criteria and Total Number of Errors Detected

Dispensing			
S. No.	Audit Criteria	Total Prescriptions Audited	No. of Errors
1	Wrong drug dispensed	350	3
2	Wrong dose dispensed	350	3
3	Wrong formulation dispensed	350	0
4	Expired/ near-expiry drug dispensed	350	1
5	No/ wrong labelling	350	2
6	Delay in dispense	350	0
7	Generic or class substitution done without consultation with the prescribing doctor	350	0

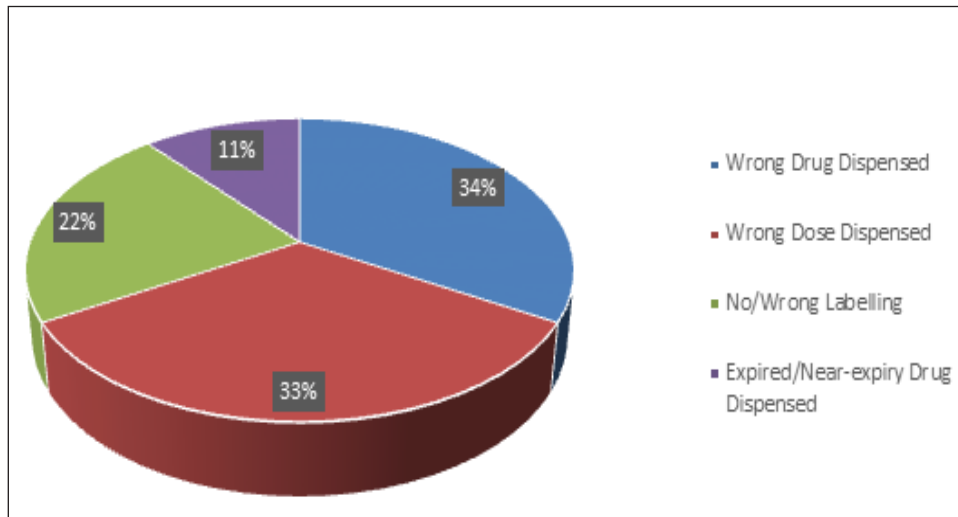


Figure 3. Dispensing Errors

Table 3. Administration Errors with Criteria and Total Number of Errors Detected

Administration			
S. No.	Audit Criteria	Total Prescriptions Audited	No. of Errors
1	Wrong patient	350	0
2	Dose omission	350	5
3	Improper dose	350	7
4	Wrong drug	350	4
5	Wrong dosage form	350	3
6	Wrong route of administration	350	0
7	Wrong rate	350	1
8	Wrong duration	350	0
9	Wrong time	350	2
10	No documentation of drug administration	350	2

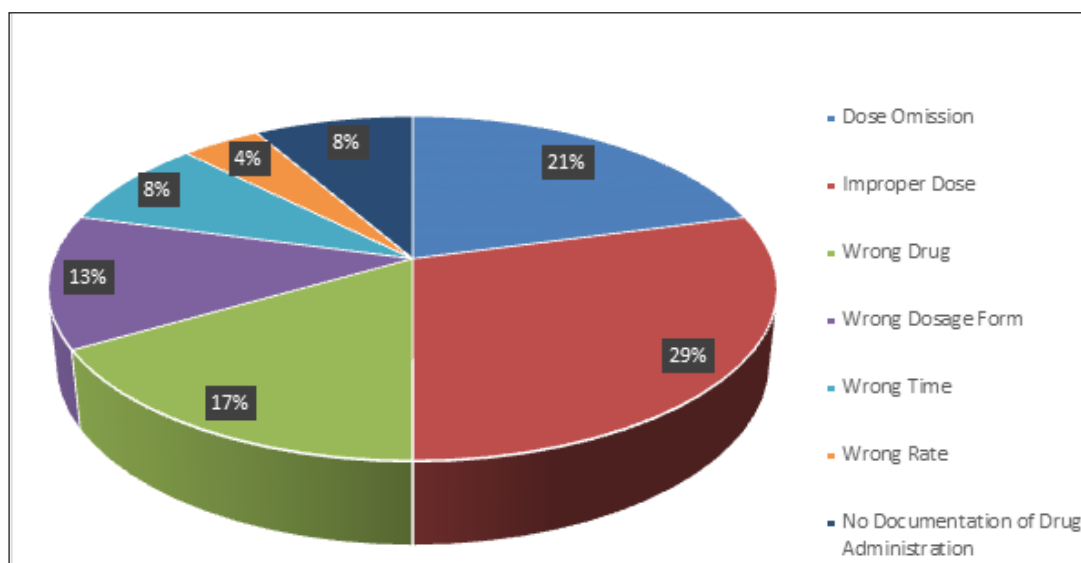


Figure 4. Administration Errors

Discussion

The study identified significant prescribing errors, particularly in dosage, units, and medication concentration, highlighting the need for improved clarity and precision in prescription writing. Predominantly, prescribing errors emerged as a significant concern, with 151 instances identified among 350 prescriptions. These errors encompassed various aspects, including dosage inaccuracies, unit discrepancies, and issues with medication concentration and dilution. Additionally, the use of ambiguous abbreviations contributed to the potential for medication errors. Dispensing errors, though fewer in number (9 errors), highlighted the importance of vigilant oversight during the dispensing process, particularly in verifying the correct drug, dose, and labelling. Furthermore, administration errors, totalling 24 instances, emphasised the need for meticulous attention to detail by nursing staff. These errors ranged from dose omissions to incorrect drug administration, underlining the critical role of healthcare professionals in ensuring safe medication practices. Notably, documentation errors were also observed among the administration errors, underscoring the importance of accurate record-keeping in patient care. Overall, the study findings underscore the multifaceted nature of medication errors and the imperative for comprehensive strategies to mitigate risks across all stages of the medication use process. Addressing prescribing errors requires enhanced clarity and precision in prescription writing practices, alongside measures to minimise abbreviations and improve drug interaction awareness. In the dispensing phase, robust checking procedures and adherence to labelling protocols are essential to prevent errors. Additionally, healthcare providers must prioritise thorough training and ongoing education to promote adherence to proper administration techniques and documentation practices. By addressing these findings comprehensively, healthcare systems can enhance medication safety and improve patient outcomes.

Future Scope of This Study

The results of the study provide a number of directions for further investigation and action that can help to lower prescription errors frequencies and enhance patient safety. Key areas for future exploration include:

- **Advanced Technology Integration:** Investigate the effectiveness of electronic prescribing, barcode systems, and AI tools in reducing medication errors.
- **Long-Term Impact Studies:** Assess the effectiveness of interventions like standardised prescriptions and enhanced verification processes over time.
- **Interdisciplinary Training:** Explore how collaborative training programs among healthcare providers can improve medication safety.
- **Patient Engagement:** Study the effects of involving patients more actively in their medication management.

- **Cultural and Systemic Factors:** Examine how organisational culture and systemic issues impact medication errors and develop strategies to address them.
- **Policy Evaluation:** Analyse the impact of new policies and regulations on medication error rates and patient safety.
- **International Comparisons:** Compare medication safety practices and error rates across different healthcare systems and countries to identify best practices.

These areas of research will help refine strategies to minimise medication errors and improve overall patient safety.

Novel Element of This Study

- **Local Focus:** Looks closely at medication errors in a specific healthcare setting, considering local practices and issues.
- **Innovative Methodology:** Utilises advanced audit tools, such as updated PQI, and integrates technology like EHR analysis and AI for real-time error detection.
- **Detailed Analysis:** Breaks down errors into specific types and root cause analysis of medication errors which investigates their causes in depth.
- **Impact Evaluation:** Measures the immediate and long-term effects of errors on patients, costs, and overall well-being.
- **Custom Solutions:** Suggests new, tailored strategies for fixing errors and improving practices, with follow-up to check their effectiveness.
- **Involved Stakeholders:** Engages a range of people, including patients, to ensure practical and effective solutions.
- **Educational and Policy Changes:** Provides new learning resources and recommendations for better policies to improve medication safety.

Conclusion

The study highlights the pervasive nature of medication errors across the prescribing, dispensing, and administration stages, emphasising the critical need for proactive interventions to enhance patient safety. The high prevalence of prescribing errors, including dosage inaccuracies and abbreviation misuse, underscores the importance of standardised prescription practices and increased awareness among healthcare providers. Similarly, while dispensing errors were fewer in number, they underscore the significance of rigorous verification processes to prevent incorrect drug dispensation. Furthermore, administration errors, coupled with documentation inaccuracies, underscore the essential role of vigilant nursing oversight and meticulous record-keeping in minimising medication-related risks. Addressing these findings requires a multifaceted approach

encompassing improved prescription clarity, enhanced dispensing protocols, and comprehensive staff training on safe medication practices. By implementing robust quality assurance measures and fostering a culture of continuous learning and improvement, healthcare systems can mitigate medication errors, safeguard patient well-being, and ultimately enhance the overall quality of care delivery.

Source of Funding: None

Conflict of Interest: None

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