

Incidence of Medication Error in Critical Care Unit of a Tertiary Care Hospital: Where Do We Stand?

Kapil G Zirpe¹, Bhavika Seta², Sharvari Gholap³, Khadija Aurangabadi⁴, Sushma K Gurav⁵, Abhijeet M Deshmukh⁶, Prajкта Wankhede⁷, Prasad Suryawanshi⁸, Swapna Vasanth⁹, Mariamma Kurian¹⁰, Elizabeth Philip¹¹, Nirmala Jagtap¹², Esther Pandit¹³

ABSTRACT

Background: Medication error in developed countries is of primary concern when there is a question of adversity to a patient's health, but in developing countries like India, it is just a term and its significance is undervalued. The incidence of medication error is essential to estimate the proper medical care provided in the healthcare system.

Objective: The main objective of the study is to determine the incidences of medication error in critical care unit and to evaluate its risk outcomes.

Materials and methods: This is a prospective observational study conducted over a period of 6 months in a critical care unit of a tertiary care hospital. Medication chart review method was opted for data collection. The medication errors were mainly classified as prescription, transcription, indenting, dispensing, and administration error. A total of 6,705 charts were reviewed. The NCCMERP risk index was used to evaluate the outcome of errors.

Results: Of the total 6,705 charts, 410 medication errors were found, i.e., 6.11%. The most common error is transcription error that constitutes 44.1% of the total errors, followed by prescription error 40%, and administration error 14%. The frequency of indenting and dispensing errors is negligible with 1.5% and 0.5%, respectively. The main causes of medication errors are due to incomplete prescription 50.2% and wrong doses 22.9%. In drug class, antibiotics and antihypertensive agents are most prone to medication error. About 87.1% errors belonged to the Category B of National Coordinating Council for Medication Error Reporting and Prevention risk index.

Conclusion: Majority of the errors are transcription errors followed by prescription and administration errors. Consultant doctors have to be more vigilant during prescribing and verifying the medication charts. Clinical pharmacists should act as a checkpoint at each step of medication process to identify and prevent medication errors.

Keywords: Intensive care, Legal issues, Medication error, Risk factor.

Indian Journal of Critical Care Medicine (2020); 10.5005/jp-journals-10071-23556

INTRODUCTION

The National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP) has defined 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 health care professional, patient, or consumer. These events may be related to professional practice, healthcare products, procedures, and systems, including prescribing, order communication, product labeling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use".¹ Thus, any medication error can be prevented before it may or may not cause harm to the patient.

Medication error can be classified in a number of ways. The most frequently used classification method in hospital settings is according to the stage at which error occurs in the process of medication use, such as prescription, transcription, dispensing, administration, or monitoring. The other one is psychological classification that consists of knowledge-based error, rule-based error, action-based, error and memory-based error.^{2,3}

The seriousness of medication error came to be known when Institute of Medicine (US) stated in, "To Err is Human; Building a Safer Health System," that around 44,000 to 98,000 deaths in America occurred as a result of medical errors.^{4,5} The impact of medication error on patient's well-being is unfathomable. The reported medical errors are a tip of an iceberg of actual incidences occurring in

^{1-5,7-13}Neuro Trauma Unit, Grant Medical Foundation, Pune, Maharashtra, India

⁶Neuro Trauma Stroke Unit, Grant Medical Foundation's Ruby Hall Clinic, Pune, Maharashtra, India

Corresponding Author: Kapil G Zirpe, Neuro Trauma Unit, Grant Medical Foundation, Pune, Maharashtra, India, Phone: +91 9822844212, e-mail: kapilzirpe@gmail.com

How to cite this article: Zirpe KG, Seta B, Gholap S, Aurangabadi K, Gurav SK, Deshmukh AM, *et al.* Incidence of Medication Error in Critical Care Unit of a Tertiary Care Hospital: Where Do We Stand? *Indian J Crit Care Med* 2020;24(9):799-803.

Source of support: Nil

Conflict of interest: None

a healthcare system.³ Most of the medication errors do not cause any harm to the patient, but there are some that cause unwarranted results, including temporary or permanent harm to the patient's health and well-being, increased length of hospitalization, increase in cost of treatment, people losing faith in healthcare delivery system, and even deaths.^{6,7}

What is the scenario of medication error reporting in India? Prof Jha in his study showed that around 5.2 million medical errors take place in India annually. Similarly, the *British Medical Journal* quoted that India, like any other developing country, is

recording a lot of medical errors. The main reason being that we do not have trained doctors and nurses to measure the clinical outcomes.⁸

The primary aim of our study is to calculate the incidences of medication error in a critical care unit based on its type and nature and to determine the most common error and its possible root cause and outcome on patients' health.

MATERIALS AND METHODS

The process followed in the hospital involving medication initiates with a physician writing the prescription after the patient's admission followed by placing the indent for the prescribed medication by the pharmacist/nurses to the hospital pharmacy. The pharmacy then dispenses the required medicines to the patient which is then administered later by nurses. Next day, the prescription is transcribed by junior doctors and then checked and signed by the consultant doctors. Efficacy and safety of treatment are then monitored by the treating doctors. A medication error can occur at any of these stages or may occur at times on multiple stages directly affecting the patients' care and/or economical burden.

Study Design

A prospective observational study was conducted over a period of 6 months in the critical care unit of a tertiary care hospital.

Study Population

Patients admitted to the critical care unit during the study period irrespective of age, sex, and diagnosis were included in the study. Random method was used for sampling of the patient.

Data Collection

Two clinical pharmacists were responsible for data collection. Medication chart review method was used to identify medication errors. Total 6,705 medication charts were reviewed. Apart from medication charts, patient's bedside medicines, medication bill, and partially used or empty drug vial/ampoule and pill count in case of oral drugs were checked for identifying medication errors.

All the medication errors were mainly categorized as prescription, transcription, indenting, dispensing, and administration errors. These medication errors were further subdivided according to their causes which included incomplete prescription, illegible prescription, wrong drug, wrong dose, wrong frequency, wrong route, wrong time, wrong formulation, wrong dilution, omission, error prone abbreviation (ISMP's list of error prone abbreviation),⁹ and therapeutic duplication.

The outcome of medication error was assessed using NCCMERP risk index as described in Table 1.¹⁰ Category A and category B comprise intercepted errors, whereas category C to category I are actual errors.

RESULTS

Out of the total 6,705 charts reviewed, 410 (6.11%) medication errors were found which makes 6.11%. Transcription error is found to be at peak with 44.1% followed by prescription and administration errors with 40% and 14%, respectively. The incidence of indenting and dispensing error is found to be very low with 1.5% and 0.2%, respectively. Thus, the commonest type of error is transcription error.

While further evaluating the causes of medication error, the most common cause found is due to incomplete prescription

(ideal complete prescription includes dosage form, name, dose, frequency and route of drug) comprising 50% of the total errors, which is followed by wrong dose and wrong drug with 22.9% and 8%, respectively (Tables 2 to 4).

Most of the transcription error is due to incomplete prescription (60.7%). Wrong dose and wrong drug cover almost 21% and 11%, respectively. In wrong drug, mainly incorrect transcription of Tab.

Table 1: NCCMERP Index for categorizing medication errors

Category	Description	Inference
A	Events have the capacity to cause error	No error
B	An error occurred but did not reach the patient	Error, no harm
C	An error occurred reached the patient but did not cause potential harm	Error, no harm
D	Error occurred reached the patient and required monitoring	Error, no harm
E	An error occurred that resulted in temporary harm to the patient and required intervention	Error, harm
F	An error occurred that resulted in temporary harm to the patient and required initial or prolonged hospitalization	Error, harm
G	An error occurred and resulted in permanent patient harm	Error, harm
H	An error occurred that required intervention necessary to sustain life	Error, harm
I	An error occurred and resulted in patient's death	Error, death

Table 2: Frequency of types of medication errors

Type of error	Number of cases	Percentage
Transcription error	181	44.1
Prescription error	164	40.0
Administration error	58	14.1
Indenting error	6	1.5
Dispensing error	1	0.2

Table 3: Frequency of causes of medication errors

Causes	Number of cases	Percentage
Incomplete prescription	206	50.2
Wrong dose	94	22.9
Wrong drug	33	8.0
Illegible prescription	30	7.3
Omission	17	4.1
Therapeutic duplication	9	2.2
Wrong dosage form	8	2.0
Error prone abbreviation	3	0.7
Wrong dilution	3	0.7
Wrong duration	2	0.5
Wrong frequency	2	0.5
Wrong time	2	0.5
Wrong route	1	0.2

Table 4: Distribution of types of medication error according to their causes

Subtype	Administration error	Dispensing error	Indenting error	Prescription error	Transcription error
Error-prone abbreviation	0	0	0	3	0
Illegible prescription	0	0	0	30	0
Incomplete prescription	0	0	0	96	110
Omission	13	0	0	1	3
Therapeutic duplication	0	0	0	9	0
Wrong dilution	1	0	0	2	0
Wrong dosage form	0	0	0	3	5
Wrong dose	36	1	1	18	38
Wrong drug	7	0	5	1	20
Wrong duration	0	0	0	1	1
Wrong frequency	0	0	0	0	2
Wrong route	0	0	0	0	1
Wrong time	1	0	0	0	1
Total	58	1	6	164	181

Table 5: Distribution of medication classes involved in medication error

Drug class	n (%)	Drug class	n (%)
Analgesic	40 (9.75)	Anti-thrombolytic	21 (5.12)
Antacid and antiemetic	28 (6.82)	Bronchodilators	01 (0.24)
Anti-arrhythmic	02 (0.48)	Electrolyte concentrate	09 (2.19)
Antibiotic	81 (19.75)	Hypoglycemic agents	04 (0.97)
Antiepileptic	20 (4.87)	Multivitamin	05 (1.21)
Anti-hemorrhagic	05 (1.21)	Others	83 (20.24)
Antihistamine	03 (0.73)	Sedatives and hypnotics	13 (3.16)
Antihypertensive	46 (11.21)	Lipid-lowering drugs	05 (1.21)
Antiplatelet	26 (6.34)	Corticosteroids	15 (3.65)
Antipsychotics	02 (0.48)	Thyroid agent	01 (0.24)

Ecosprin AV to Tab. Ecosprin and Tab. Telma CT to Tab. Telma is present. This indicates that combination drugs are prone to such errors.

In case of prescription errors, the most common cause was incomplete prescription (58.5%), followed by illegible prescription (18.3%), and wrong dose (11%).

Administration errors are common due to wrong dose administration (62%) and omission error (22.4%). While evaluating wrong dose it was found that almost all the errors occurred due to underdosing. For example, Injection Meropenem 2 g was prescribed and only 1 g was administered to the patient; similarly, Injection Levetiracetam prescribed 1 g and administered 500 mg. The most logical root cause here is the use of multiple vials/ampoules for administration of prescribed dose.

Majority of the medication errors are due to the drugs belonging to the class antibiotic (19.75%), followed by anti-hypertensive (11.21%), and analgesic drugs (9.75%). The highest incidence of medical errors due to antibiotics is a matter of concern (Table 5).

None of the medication error caused any significant harm such as temporary or permanent damage and death of the patient. Majority of the errors come under the category B of error outcome, that is error occurred but did not reach the patient. Thus, total 87.6% of errors are prevented, and 12.4% are actual errors (Tables 6 and 7).

Table 6: Frequency of medication errors according to NCCMERP risk index

Outcome error	Number of cases	Percentage
A	2	0.5
B	357	87.1
C	51	12.4

Table 7: Distribution of types of medication errors according to NCCMERP risk index

Type of error	Outcome error		
	A	B	C
Administration error	0	12	46
Dispensing error	0	1	0
Indenting error	0	3	3
Prescription error	1	162	1
Transcription error	1	179	1
Total	2	357	51

DISCUSSION

The main purpose of this study was to determine the incidence of medication error based on their types and outcomes. On

further investigation, it has been observed that the benchmark for medication error differs in every organization. Basically, it depends on the understanding of what comes under medication error, their reporting and practices followed in order to prevent and reduce them.

The result of this study has shown that 6.11% of medication errors occurred in the critical care unit of the hospital. This finding was low when compared to a similar study in West Ethiopia (Mohammed et al.) and India (Eisa-Zaei et al.) which reported 46% and 42.85% of medication errors, respectively.^{11,12} The major factor for low rates of medication error is underreporting. When further analyzed it has been observed that except clinical pharmacists, no other healthcare provider reported any medication error, and self-reporting was not evident. The level of understanding and knowledge among doctors and nurses regarding medication error identification and reporting was minimal. The fear of blame and forfeit has been the major concern among the healthcare professionals leading to lower medical error reporting. A system that encourages error reporting should be instituted by means of rewarding or appreciating self-reporting and creating safety environment for healthcare personnel.¹³ Organization must be blame free and should work in accordance to facilitate open communication.¹⁴ Hospital accreditation necessitates reporting of medication error as a continuous quality improvement tool that could be helpful in increasing error reporting rate.

Consistent with former research, there is preponderance of transcription error in our study with 44.1%.¹⁵ Incomplete prescription is the major reason for transcription error. In most of the prescriptions, dose of the drug was missing, which ultimately resulted in delay and administration of wrong dose to the patient. In our setting, junior doctors transcribe medications on order chart. Their lack of experience and inadequate knowledge have further promoted the chances of errors. They must have full knowledge regarding the treatment given to the patient and should not just copy and paste from previous orders. However, almost all the transcription errors have been prevented before they could reach the patient through timely identification and intervention by clinical pharmacists and consultant doctors.

The rate of prescription error in present study is 40%, and it complies with the study conducted in the United Kingdom that showed 36% of prescription errors.¹⁶ Prescription errors were mainly due to incomplete and illegible prescription. This finding is similar to the study conducted by Venkateswar in Tamil Nadu.¹⁷ Incomplete prescription writing leads to incomplete transcription. This could be easily prevented if prescriptions are written in an ideal complete format in legible handwriting. Use of Computerized Physician Order Entry (CPOE) could be beneficial in reducing prescribing errors and in increasing compliance to complete prescription.¹⁸

Our study reported 14.1% of administration error which is comparatively low when compared to the study conducted by Patel et al. who reported 31%.¹⁹ Wrong dose (under-dosing) and omission error are the most common reasons for administration error. Wrong dose administration eventuates when single dose is administered instead of multiple doses of vials/ampoules. Clinical pharmacist could play a key role in preventing such errors by simply highlighting on medication chart the number of doses to be administered.

The most common class of drugs prone to error are antibiotics, antihypertensives, and analgesics, which is similar to the findings of study conducted by Zeleke et al.²⁰ The probable reason is because

these are the most prescribed drugs in critical care unit. Meropenem, telmisartan, and paracetamol are the drugs commonly involved in medication error. It is a matter of concern that medication error primarily involving broad-spectrum antibiotic (under-dosing) may significantly contribute to antimicrobial resistance.

The outcome of the error in our study was measured using NCCMERP harm score index with majority of the errors in category B (87.5%) and category C (12.4%). On contrary, a study in West Ethiopia encountered majority of the errors in category C (63.1%) followed by category B (20.6%).¹¹ No fatal casualty has been observed due to medication error. Most of the errors have been prevented before they could reach the patient. This is because of the active surveillance by clinical pharmacist on each step of medication process.

LIMITATIONS

This study includes some limitations. The primary limitation is that it is a "single-center" study. All other wards (general, private, semi-private) were excluded. Clinical pharmacist reviewed the chart during their 8 hours duty from morning to evening. Medication error during night time was not identified and reported. Another limitation is that monitoring error was not reported and evaluated.

CONCLUSION

Medication errors are routinely encountered but remain underreported. Reporting is important to thoroughly examine their contributing factors and to implement preventive actions so as to avoid them in future from happening. Our study reported that transcription error is the commonest error followed by prescription and administration error. Incomplete prescription is the major reason for prescription and transcription error. Implementation of electronic prescription could be helpful in preventing medication error because of incomplete and illegible prescribing. In our study, there was never an incident where medication error caused harm to a patient. However, continuous monitoring at each step of medication process by clinical pharmacists is necessary to prevent them in future. Thus, clinical pharmacists play a central role in identification and prevention of medication error by conducting various medication audits and providing training to healthcare professionals to achieve safe and effective medical outcome.

REFERENCES

1. Retrieved from <https://www.nccmerp.org/about-medication-errors>, 2020.
2. Ferner RE, Aronson JK. Clarification of terminology in medication errors: definitions and classification. *Drug Saf* 2006;29(11):1011–1022. DOI: 10.2165/00002018-200629110-00001.
3. Ambwani S, Misra AK, Kumar R. Medication errors: Is it the hidden part of the submerged iceberg in our health-care system? *Int J Appl Basic Med Res* 2019;9(3):135–142. DOI: 10.4103/ijabmr.IJABMR_96_19.
4. Donaldson MS. An overview of *to err is human*: re-emphasizing the message of patient safety Hughes RG, ed. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.
5. Walker EE. Medication errors. *Imper J Interdisciplin Res* 2016;2(5):125–131.
6. Gorgich EA, Barfroshan S, Ghoreishi G, Yaghoobi M. Investigating the causes of medication errors and strategies to prevention of them from nurses and nursing student viewpoint. *Glob J Health Sci* 2016;8(8):54448. DOI: 10.5539/gjhs.v8n8p220.

7. Webster CS, Anderson DJ. A practical guide to the implementation of an effective incident reporting scheme to reduce medication error on the hospital ward. *Int J Nurs Pract* 2002;8(4):176–183. DOI: 10.1046/j.1440-172x.2002.00368.x.
8. Aashita SA, Khan ZH, Khokhar A. Basic concept of patient safety in healthcare delivery. *Int J Curr Res* 2018;10(8):72926–72932.
9. Retrieved from <https://www.ismp.org/recommendations/error-prone-abbreviations-list>, 2017.
10. Retrieved from <https://nccmerp.org/categorizing-medication-errors-index-color>, 2001.
11. Dedefo MG, Mitike AH, Angamo MT. Incidence and determinants of medication errors and adverse drug events among hospitalized children in West Ethiopia. *BMC Pediatr* 2016;16(1):81. DOI: 10.1186/s12887-016-0619-5.
12. Eisa-Zaei A, Hiremath SRR, Prasad S. Comprehensive evaluation of medication errors incidence at a tertiary care hospital. *Int J Pharmaceut Sci Res* 2018;9(12):5315–5319.
13. Lee E. Safety climate and attitude toward medication error reporting after hospital accreditation in South Korea. *Int J Qual Health Care* 2016;28(4):508–514. DOI: 10.1093/intqhc/mzw058.
14. Wolf ZR, Hughes RG. Error reporting and disclosure Hughes RG, ed. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.
15. Lisby M, Nielsen LP, Mainz J. Errors in the medication process: frequency, type, and potential clinical consequences. *Int J Qual Health Care* 2005;17(1):15–22. DOI: 10.1093/intqhc/mzi015.
16. Ryan C, Ross S, Davey P, Duncan EM, Francis JJ, Fielding S, et al. Prevalence and causes of prescribing errors: the prescribing outcomes for trainee doctors engaged in clinical training (PROTECT) study. *PLoS ONE* 2014;9(1):e79802. DOI: 10.1371/journal.pone.0079802.
17. Murthy VN. Evaluation and categorization of medication errors occurred in cardiology department of tertiary care hospital. *J Basic Clin Pharm* 2017;8:S060–S063.
18. Nuckols TK, Smith-Spangler C, Morton SC, Asch SM, Patel VM, Anderson LJ, et al. The effectiveness of computerized order entry at reducing preventable adverse drug events and medication errors in hospital settings: a systematic review and meta-analysis. *Syst Rev* 2014;3(1):56. DOI: 10.1186/2046-4053-3-56.
19. Patel N, Desai M, Shah S, Patel P, Gandhi A. A study of medication errors in a tertiary care hospital. *Percept Clin Res* 2016;7(4):168–173. DOI: 10.4103/2229-3485.192039.
20. Zeleke A, Chanie T, Woldie M. Medication prescribing errors and associated factors at the pediatric wards of Dessie referral hospital, Northeast Ethiopia. *Int Arch Med* 2014;7(1):18. DOI: 10.1186/1755-7682-7-18.