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Incidences and classification of medication errors - a case study

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ABSTRACT

Background. *The Medication errors (MEs) severely affect ill health or death and have a substantial financial effect on the patient and health care organization. The present study aims to detect the incidences and classify MEs and increase the patient safety medication of Super Specialty Hospital, Kolkata.*

Materials and Methods. *The prospective observational study of patient prescriptions, transcription, indenting, dispensing, and administration were followed up daily to identify the medication errors in 400+ beds across each admitted inpatient department (IPD) patients file from June 2019 to July 2019 at a Super Specialty Hospital, Kolkata.*

Results. *A total of 395 prescriptions were reviewed in the present study. A total of 29.36% of medication errors have been reported. In June 2019, MEs occurrence rate was 44.85%. The most common MEs were found in Transcription errors (TEs) (77.72%), followed by Administration errors (AEs) (55.44%), Prescription errors (PEs) (55.18%), Dispensing errors (DEs) (31.89%), and Indenting errors (IEs) (4.05%). In comparison, 13.87% of medication errors occurred in July 2019, four times less than in June 2019, with 28.10% in PEs, followed by TEs at 24.05%, AEs at 9.11%, DEs at 8.10% and 0% in IEs.*

Conclusion. *This study revealed that MEs occurred from the common mistake of illegible handwriting, which causes many problems while transcribing and indenting medicine by chemists and nurses while cross-checking the patient file documentation with a medicine card. Further study is needed to determine the factors governing MEs low reporting.*

Keywords: medication errors, prescription, medication, healthcare

INTRODUCTION

Medication errors (MEs) are a mutual source of contrary healthcare episodes that influence carefulness eminence. MEs could reason for up to one-third of all errors in the hospital [1]. As stated by the National coordinating council for medication error reporting and prevention (NCCMERP), MEs are any avertable incident that could change the essence or principal to unsuitable medication practice or patient harm [2-5]. Not all MEs cause illness or death, but a comparatively excessive rate makes it a problematic cost to deal with [6]. The emergency department (ED) is at the forward-facing of avoiding MEs and the necessity to educate the wakefulness of the problem and select schemes to exclude the difficulty and lessen harm if mistakes happen [7]. The MEs affect severely ill health or death and have

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a substantial financial effect on the patient and health care organization [8]. Self-medication, poor message amongst the doctor/chemist and the patient, medicine requests by the inpatient or outpatients for any symptoms, unethical drug promotion, and an increasing number of irrational prescribing of drugs per prescription may cause ME [9]. There are five stages of drug ordering and distribution in all hospitals: 1) prescription, 2) transcription, 3) dispensing, 4) administration and 5) Indenting [10,11]. The two mutual features allied with prescribing errors are the absence of information about the drug prescribed and for whom it has to be stated. The wrong choice of medications is one of the frequent prescribing errors [12,13]. Transcription errors denote statement failures among prescribing clinicians and dispensing staff. The dispensing of medicine is the last chance to rectify the medication error for patients discharged from the hospitals and a need for continuous medication [14-17]. Administration errors occur as soon as the incorrect medicine is administered or the right drug is administered in the wrong dose or via the wrong route [18,19]. A hectic list, the impulse to complete work as early as possible and omitted double-checking/validating prescription orders can accompany the administration's wrong route. These causes not only surge the patient risk but also raise the charge of cure [20]. Work period, extra time, and the number of hours worked per week significantly affect the error level. The probability of an error is three times much greater for shifts durable more than 12.5 hours. Extra time increases the chances of mistakes [21]. The number of errors increases with a risen in confirmed medication orders per shift [22,23]. Highly qualified and registered nurses assigned per patient day will result in fewer errors. High levels of licensed practical nurses (LPN) result in surplus errors [24,25]. Nurses' involvement in hospital affairs, eminence, and the mutual relation between nurse-physician, encouraging and proficient nurse executive were associated with inaccuracy halt practices. Staffing and capitals had no connotation with error interference practices [26,27]. The present study aims to detect the incidences and categorize medication errors and increase the patient safety medication of Super Specialty Hospital, Kolkata.

MATERIALS AND METHODS

This study was based on prospective observational examining the MEs sources and hindrances. The primary data was collected by observing the patient prescriptions, transcriptions, indenting, dispensing, and administration from all the Inpatient department (IPD) patients from June to July 2019 at Super Speciality Hospital, Kolkata.

For prescribing errors different criteria are applied to check the files, including prescriptions, doctor progress notes, and emergency assessments like: - Prescribing the wrong medicine, prescribing to the wrong Patient, Prescribing the Wrong Dose, Prescribing the wrong Route, Prescribing the wrong Frequency, Illegible handwriting, Prescription in Capital Letter, Prescription in Generic.

For Transcription errors, doctor progress notes, Medicine cards, RMO notes, and patient files, UHID has been checked covering these criteria: Prescribing the wrong medicine, prescribing to the wrong Patient, Prescribing the Wrong Dose, Prescribing the wrong Route, Prescribing the wrong Frequency, Illegible handwriting, Prescription in Capital Letter, Prescription in Generic, Signature, Name, Date & Time.

For Indenting errors, each floor, including ITU, Nephron ward, 4th floor, CCU, 5th floor, and 6th floor, has been checked: Indenting wrong medicine, indenting to wrong Patient, Indenting Wrong Dose, Indenting the wrong Route, Indenting wrong Frequency.

For Dispensing error, the out-patient (OP) Pharmacy and In-patient (IP) Pharmacy was observed for: Dispensing the wrong medicine, dispensing to wrong Patients, Dispensing the Wrong Dose, dispensing the wrong Dosage Form, and cold Chain not maintained.

For administration error, on each floor, In-patient files, during medicine administration to patients by nurses, documentation and expiry date of medicine were checked covering these criteria: Preparation of wrong drug, wrong labeling of the drug, Administering Wrong medication, administering to the wrong patient, administering wrong dose/rate, administering wrong route/doses form, Administering wrong frequency, Expired medicine/drug, Error of omission, Wrong technique, Documentation error [28,29].

All statistical analyses were performed with the help of SPSS 23.0 software.

RESULTS & DISCUSSION

A total of 395 prescriptions, transcriptions, indenting, dispensing, and administration files of admitted inpatients were observed throughout June-July, 2019. The total number of medication errors was 44.85% in June 2019. The most common MEs were TE (77.72%), followed by AE (55.44%), PEs (55.18%), DE (31.89%), and IE (4.05%) in June 2019. In comparison, 13.87% of medication errors occurred in July 2019, which was four times lesser than in June 2019, and among them, the most MEs occurred in PEs at 28.10%, followed by TEs at 24.05%, AEs with 9.11%, DEs with 8.10% and 0% in IEs.

Prescription Errors

It was found that overall, 55.18% of prescription errors were in June 2019. Among them, 0% prescribed

the wrong medicine, patients, doses, and route for both June and July 2019. While most PEs was observed in 120 prescriptions due to Illegible handwriting, followed by 82 prescriptions written in Capital Letters and then 16 prescriptions with incorrect frequency (Table 1). In July 2019, the prescription error was reduced to 28%. In comparison, prescriptions with wrong frequency prescribing were found at 0%, while 28 prescriptions were found with Illegible handwriting, followed by 33 prescriptions written in Capital Letters in July 2019. Error in prescribing includes dosage form, abbreviation, wrong drug name, lack of knowledge, incorrect dosage calculations, illegible handwriting, written in capital letters, wrong patient, and wrong route [30,31].

TABLE 1. *Prescription errors for the month of June-July-2019*

Prescription errors	June-2019		July-2019	
	n	%	n	%
a. Prescribing wrong medicine	0	0%	0	0%
b. Prescribing to wrong Patient	0	0%	0	0%
c. Prescribing Wrong Dose	0	0%	0	0%
d. Prescribing wrong Route	0	0%	0	0%
e. Prescribing wrong Frequency	16	7%	0	0%
f. Illegible handwriting	120	55%	28	46%
g. Prescription in Capital Letter	82	38%	33	54%
h. Prescription in Generic	0	0%	0	0%
Total (N) = 395	**218**	100%	**61**	100%

N: total number of samples

Transcription error

A total of 395 inpatient transcriptions were collected, and a total of 77.72% of TEs was detected mainly due to illegible handwriting followed by lack of signature, name, date & time, and prescription in capital letter and due to prescribing drugs in the wrong frequency in June-2019 and it was decline to 24.05% in July-2019. For June 2019 and July 2019, we observed 0% transcription errors for prescribing the wrong medication, wrong patients, wrong dose, wrong route, and a generic name. In comparison, sixteen transcriptions were found to have a transcription error in Prescribing the wrong Frequency for June 2019 and 0% for July 2019. For June 2019, 120 transcriptions were found to have 39% of TEs due to Illegible handwriting, while it reduced to 28 (29%) in July 2019. For June 19, eighty-two transcription was detected, with 29% of TEs due to prescription written in a capital letter, while in July 2019, 33 (35%) transcriptions were reported. The lack of sign, date, and medication time was detected up to 89 (29%) for June 2019, while for July 2019, 34 (36%) (Table 2).

Indenting error

A total of 395 inpatients intending was collected, and 4.05% indenting error was observed for June 2019, while in July 2019, 0% occurrence was reported. The

TABLE 2. *Transcription errors for the month of June-2019 and July-2019*

Transcription error	June-2019		July-2019	
	n	%	n	%
a. Prescribing wrong medicine	0	0%	0	0%
b. Prescribing to wrong Patients	0	0%	0	0%
c. Prescribing Wrong Dose	0	0%	0	0%
d. Prescribing wrong Route	0	0%	0	0%
e. Prescribing wrong Frequency	16	5%	0	0%
f. Illegible handwriting	120	39%	28	29%
g. Prescription in Capital Letter	82	27%	33	35%
h. Prescription in Generic	0	0%	0	0%
i. Signature, Name, Date & Time	89	29%	34	36%
Total (N) = 395	**307**	100%	**95**	100%

results showed 0% indenting wrong medicine, wrong patient, wrong dose, and wrong route for June 2019 and July 2019. Sixteen prescriptions out of 395 were found to be given with the wrong frequency in June 2019 and 0% in July 2019 (Table 3). This study revealed that the indenting system and procedure were correct (Table 3).

TABLE 3. *Indenting error for the June-July 2019*

Indenting error	June-2019		July-2019	
	n	%	n	%
a. Indenting wrong medicine	0	0%	0	0%
b. Indenting to wrong Patient	0	0%	0	0%
c. Indenting Wrong Dose	0	0%	0	0%
d. Indenting wrong Route	0	0%	0	0%
e. Indenting wrong Frequency	16	100%	0	0%
Total (N) = 395	**16**	100%	**0**	0%

Dispensing error

A total number of 395 inpatient dispensing were collected. There was a 31.89% occurrence of dispensing errors in June 2019, while in July 2019, the occurrence rate was 8.10%. The result indicates that 0% of dispensing wrong medicine, wrong patients, wrong dose, and fifty-five DEs for dispensing wrong dosage form in June 2019, and later on, 32 DEs in July 2019, and seventy-one DEs were found for cold chain not maintained for months of June-2019 and 0% DEs for July-19 (Table 4).

TABLE 4. *Dispensing error for the June and July-2019*

Dispensing error	June-2019		July-2019	
	n	%	n	%
a. Dispensing wrong medicine	0	0%	0	0%
b. Dispensing to wrong patient	0	0%	0	0%
c. Dispensing wrong dose	0	0%	0	0%
d. Dispensing wrong dosage form	55	44%	32	100%
e. Cold chain not maintained	71	56%	0	0%
Total (N) = 395	**126**	100%	**32**	100%

Administration Error

A total number of 395 inpatient administrations were collected. Fifty-five percent of AEs were found in June 2019, which was reduced to 9.11% in July 2019. It was found that 0% AEs for the preparation of the wrong drug, wrong patient, wrong dose, the error of omission, and wrong technique for both June-July 2019. The seventy-nine prescription was found to possess AEs due to the wrong labelling of the drug in June 2019, and 16 prescriptions with Wrong labelling of the drug was detected in July 2019. Eight prescriptions were seen with AEs for administering the wrong medicine in June 2019, which was reduced to 0% in July 2019. Twelve prescriptions were found for administering the wrong route/dosage form on June 19; later, four prescriptions were noticed in July 2019. Forty AEs occurred due to administering the wrong frequency for June 2019, which was reduced to four for July 2019. Forty-eight cases of AEs were found in June 2019 for administering an expired medicine/drug, while 0% in July 2019. Thirty-two documentations were detected with AEs due to documentation errors in June 2019 and decreased to 12 in July 2019 (Table 5).

TABLE 5. *Administration error of June-July 2019*

Administration errors	June-2019		July-2019	
	n	%	n	%
a. Preparation of wrong drug	0	0	0	0%
b. Wrong labelling of drug	79	36%	16	44%
c. Administering Wrong medicine	8	4.00%	0	0%
d. Administering to wrong patient	0	0%	0	0%
e. Administering wrong dose/rate	0	0%	0	0%
f. Administering wrong route/dosage form	12	5%	4	11%
g. Administering wrong frequency	40	18%	4	11%
h. Expired medicine/drug	48	22%	0	0%
i. Error of omission	0	0%	0	0%
j. Wrong technique	0	0%	0	0%
k. Documentation error	32	15%	12	33.00%
Total (N) = 395	**219**	100%	**36**	100%

This study revealed that medication errors were found to have occurred from the administration while cross-checking the patient file documentation with a medicine card [32]. A mistake that arose from the documentation is the small letter handwriting of physician prescriptions, doctor progress note, and emergency department assessment, and sometimes nurses need to remember to sign in medicine cards, record cards, etc. [33,11]. Sometimes RMO doesn't have time to write the patient's details. Sometimes nurses need to remember to change syringes under workload or work pressure. These are the medication error that rises daily [34-37]. Wrong labelling of drugs; using brand names is also an error. The common mistake is illegible handwriting, which causes many problems while indenting medicine by chemists and nurses [38-40].

SUGGESTIONS

It is necessary to set a protocol on the verbal command or instruction of drugs and "read-back" confirmation. The nurses should confirm the patient's allergy status and do independent double-checking of drugs at the time of dispensing, which have a low margin of safety; medicament leads to error among children. Safety specifications benefit from excluding this sort of fault/mistake, and staff is refreshed to the three drafts (prescription, drug, and patient) five rights (time, drug, dose, route, and patient) principle. Improving the work environment, training programs, monitoring staff, and improving communication between staff and medication error reporting can minimize the medication error problem [41-45].

CONCLUSIONS

In conclusion, this study revealed that MEs occur from the common mistake of illegible handwriting, which causes many problems while transcribing and indenting medicine by chemists and nurses while cross-checking the patient file documentation with a medicine card. This study demonstrates that Prescribing wrong Frequency, Prescription in Capital Letters, lack of Signature, Name, Date & Time, Dispensing the wrong dosage form, Wrong labeling of the drug, Administering the wrong frequency, and Expired medicine/drug were some of the governing factors which leads to MEs. Findings from this study suggest that medication errors are still rampant and need to ease these threats confronted by patients throughout healthcare. Further study is required to determine the factors governing MEs low reporting.

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Author contribution

All authors have equally contributed to the study design, data analysis, presentation of results, and the drafting and revision of the original manuscript. All authors have read and approved the final sort of the manuscript.

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REFERENCES

1. Cheragi MA, Manoocheri H, Mohammadnejad E, Ehsani SR. Types and causes of medication errors from nurse's viewpoint. Iran J Nurs Midwifery Res. 2013 May;18(3):228-31. PMID: 23983760
2. National Coordinating Council for Medication Error Reporting Index for CategorizingMedication Errors, 2001. www.NCCMERP.org. Accessed 10 June 2019.
3. Herrmann TA, Gray N, Petrova O. Staff perceptions of interdisciplinary team training and its effectiveness in reducing medical errors. Int J Healthc Manag. 2023 Apr 3;16(2):258-67. https://doi.org/10.1080/20479700.2022.2097762.
4. Tsigengagel O, Glushkova N, Khismetova Z, Korostova Y, Kussainova D, Sovetbekov D, Alchimbayeva M, Rakhypbekov T. The public's views on responsibility for medical errors in the Republic of Kazakhstan. Eur J Public Health. 2021 Oct 1;31(Supplement_3):ckab165-445. https://doi.org/10.1080/20479700.2022.2104191
5. Pathan SA, Baroudi OA, Rahman ZH, Saleh WA, Thomas SW, Jenkins D, Thomas SH. Electronic medical record error in reported time of discharge: A prospective analysis at a tertiary care hospital. Int J Healthc Manag. 2021 Jul 3;14(3):880-7. https://doi.org/10.1080/20479700.2019.1709008
6. George T, Elgharbawy MA, Fathi AA, Bhutta ZA, Pathan SA, Jenkins D, Thomas SH. Inaccuracy in electronic medical record-reported wait times to initial emergency physician evaluation. *Int J Healthc Manag.* 2017 Dec 28. 1-6. https://doi.org/10.1080/20479700.2017.1418277
7. Lee SB, Lee LL, Yeung RS, Chan JT. A continuous quality improvement project to reduce medication error in the emergency department. *World J Emerg Med.* 2013;4(3):179. doi: 10.5847/wjem.j.issn.1920-8642.2013.03.004
8. Weant KA, Humphries RL, Hite K, Armitstead JA. Effect of emergency medicine pharmacists on medication-error reporting in an emergency department. *Am J Health Syst Pharm.* 2010 Nov 1;67(21):1851-5. https://doi.org/10.2146/090579
9. Aspden P, Aspden P. Preventing medication errors. *National Acad Press.* 2007. http://books.nap.edu/openbook.php?record_id=11623
10. Patel N, Desai M, Shah S, Patel P, Gandhi A. A study of medication errors in a tertiary care hospital. *Perspect Clin Res.* 2016 Oct;7(4):168. https://doi.org/10.4103%2F2229-3485.192039
11. Tariq RA, Vashisht R, Sinha A, Scherbak Y. Medication dispensing errors and prevention. 2018. PMID: 30085607. https://europepmc.org/article/NBK/nbk519065
12. Velo GP, Minuz P. Medication errors: prescribing faults and prescription errors. *Br. J. Clin. Pharmacol.* 2009 Jun;67(6):624-8. https://doi.org/10.1111/j.1365-2125.2009.03425.x
13. Williams DJ. Medication errors. *J R Coll Physicians Edinb.* 2007 Jul;37(4):343. https://www.rcpe.ac.uk/sites/default/files/williams_1.pdf
14. Barker KN, Flynn EA, Pepper GA, Bates DW, Mikeal RL. Medication errors observed in 36 health care facilities. *Arch Intern.Med.* 2002 Sep 9;162(16):1897-903. https://doi.org/10.1001/archinte.162.16.1897
15. Croskerry P, Shapiro M, Campbell S, LeBlanc C, Sinclair D, Wren P, Marcoux M. Profiles in patient safety: medication errors in the emergency department. *Acad Emerg Med.* 2004 Mar;11(3):289-99. https://doi.org/10.1111/j.1553-2712.2004.tb02214.x
16. Suzuki R, Uchiya T, Nakamura A, Okubo N, Sakai T, Takahashi M, Kaneko M, Aiba I, Ohtsu F. Analysis of factors contributing to medication errors during self-management of medication in the rehabilitation ward: a case control study. *BMC Health Serv Res.* 2022 Dec;22(1):1-7. https://doi.org/10.1186/s12913-022-07679-y
17. Caleres G, Modig S, Midlöv P, Chalmers J, Bondesson Å. Medication discrepancies in discharge summaries and associated risk factors for elderly patients with many drugs. *Drugs-Real Wor Outc.* 2020 Mar;7(1):53-62. https://doi.org/10.1111/j.1553-2712.2004.tb02214.x
18. Benjamin DM. Reducing medication errors and increasing patient safety: case studies in clinical pharmacology. *J Clin Pharmacol.* 2003 Jul;43(7):768-83. https://doi.org/10.1177/0091270003254794
19. Wondmieneh A, Alemu W, Tadele N, Demis A. Medication administration errors and contributing factors among nurses: a cross sectional study in tertiary hospitals, Addis Ababa, Ethiopia. *BMC Nurs.* 2020 Dec;19(1):1-9. https://doi.org/10.1186/s12912-020-0397-0
20. Gladstone J. Drug administration errors: a study into the factors underlying the occurrence and reporting of drug errors in a district general hospital. *J Adv Nurs.* 1995 Oct;22(4):628-37. https://doi.org/10.1046/j.1365-2648.1995.22040628.x
21. Ali S, Aboheimed NI, Al-Zaagi IA, Al-Dossari DS. Analysis of medication errors at a large tertiary care hospital in Saudi Arabia: a retrospective analysis. *Int J Clin Pharm.* 2017 Oct;39:1004-7. https://doi.org/10.1007/s11096-017-0514-7
22. Rogers AE, Hwang WT, Scott LD, Aiken LH, Dinges DF. The working hours of hospital staff nurses and patient safety. *Health Aff.* 2004 Jul;23(4):202-12. https://doi.org/10.1377/hlthaff.23.4.202
23. Gao X, Jiang L, Hu Y, Li LI, Hou L. Nurses' experiences regarding shift patterns in isolation wards during the COVID-19 pandemic in China: A qualitative study. *J Clin Nurs.* 2020 Nov;29(21-22):4270-80. https://doi.org/10.1111/jocn.15464
24. Gorbach C, Blanton L, Lukawski BA, Varkey AC, Pitman EP, Garey KW. Frequency of and risk factors for medication errors by pharmacists during order verification in a tertiary care medical center. *Am J Health Syst Pharm.* 2015 Sep 1;72(17):1471-4. https://doi.org/10.2146/ajhp140673
25. Dall'Ora C, Saville C, Rubbo B, Turner L, Jones J, Griffiths P. Nurse staffing levels and patient outcomes: a systematic review of longitudinal studies. *Int J Nurs Stud.* 2022 Oct 1;134:104311. https://doi.org/10.1016/j.ijnurstu.2022.104311
26. Frith KH, Anderson EF, Tseng F, Fong EA. Nurse staffing is an important strategy to prevent medication errors in community hospitals. *Nurs Econ.* 2012 Sep 1;30(5):288. http://www.nursingeconomics.net/necfiles/specialissue/2012/Frith_Staffing.pdf
27. McClain J. Factors contributing to turnover: Medical surgical RNs in acute care hospitals in Alabama: A phenomenological study (Doctoral dissertation, University of Phoenix). 27831727, 1-24. https://www.proquest.com/openview/0cea9502d5d5fb921328b9f1bac393c3/1?pq-origsite=gscholar&cbl=18750&diss=y
28. Flynn L, Liang Y, Dickson GL, Xie M, Suh DC. Nurses' practice environments, error interception practices, and inpatient medication errors. *J Nurs Scholarsh.* 2012 Jun;44(2):180-6. https://doi.org/10.1111/j.1547-5069.2012.01443.x
29. Choo J, Johnston L, Manias E. Effectiveness of an electronic inpatient medication record in reducing medication errors in Singapore. *Nurs Health Sci.* 2014 Jun;16(2):245-54. https://doi.org/10.1111/nhs.12078
30. Chalasani SH, Ramesh M, Gurumurthy P. Pharmacist-initiated medication error-reporting and monitoring programme in a developing country scenario. *Pharmacy.* 2018 Dec 14;6(4):133. https://doi.org/10.3390/pharmacy6040133
31. Gupta M, Tikoo D, Pal S. Assessment of Prescription Writing Skills and Impact of an Educational Intervention on Safe Prescribing among the First-year Postgraduate Medical Students of Tertiary Care Hospital. AMEI's Current Trends in Diagnosis & Treatment. 2020 Dec 22;4(1):51-9. https://doi.org/10.5005/JP-JOURNALS-10055-0087
32. Cicero MX, Adelgais K, Hoyle JD, Lyng JW, Harris M, Moore B, Gausche-Hill M, Pediatric Committee of NAEMSP Adopted by NAEMSP Board of Directors. Medication dosing safety for pediatric patients: recognizing gaps, safety threats, and best practices in the emergency medical services setting. A position statement and resource document from NAEMSP. *Prehosp Emerg Care.* 2020 Aug 28;25(2):294-306. https://doi.org/10.1080/10903127.2020.1794085
33. 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 Aug;8(8):220. https://doi.org/10.5539%2Fgjhs.v8n8p220

34. Picton C, Loughrey C, Webb A. The need for a prescribing competency framework to address the burden of complex polypharmacy among multiple long-term conditions. *Clin Med.* 2016 Oct;16(5):470. https://doi.org/10.7861%2Fclinmedicine.16-5-470
35. Furniss D, Mayer A, Franklin BD, Blandford A. Exploring structure, agency and performance variability in everyday safety: an ethnographic study of practices around infusion devices using distributed cognition. *Saf Sci.* 2019 Oct 1;118:687-701. https://doi.org/10.1016/j.ssci.2019.06.006
36. Magalhães AM, Moura GM, Pasin SS, Funcke LB, Pardal BM, Kreling A. The medication process, workload and patient safety in inpatient units. *Rev Esc Enferm USP.* 2015;49:43-50. https://doi.org/10.1590/S0080-623420150000700007
37. Teal T. Associate and Baccalaureate Degree Nursing Students' Knowledge of and Attitudes toward Medication Errors and Reporting Medication Errors: Implications for Curriculum Development. University of Arkansas; 2019. https://www.proquest.com/docview/2235984058?pq-origsite=gscholar&fromopenview=true#
38. MacPhee M, Dahinten VS, Havaei F. The impact of heavy perceived nurse workloads on patient and nurse outcomes. *Adm Sci.* 2017 Mar 5;7(1):7. https://doi.org/10.3390/admsci7010007
39. Bryan R, Aronson JK, Williams A, Jordan S. The problem of look-alike, sound-alike name errors: Drivers and solutions. *Br J Clin Pharmacol.* 2021 Feb;87(2):386-94. https://doi.org/10.1111/bcp.14285
40. Paul P, Nath R, Gadre S, BP SK RS. A Prospective Study: Effect of Medication Error in a Tertiary Care Hospital. *Curr Med Res Opin.* 2022 Aug 4;5(08):1284-90. https://doi.org/10.52845/CMRO/2022/5-8-2
41. Hernandez LM, editor. Standardizing medication labels: Confusing patients less: Workshop summary. National Academies Press; 2008 May 15. 116. https://doi.org/10.17226/12077
42. 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 Jul;9(3):135-142. https://doi.org/10.4103%2Fijabmr.IJABMR_96_19
43. Abuelsoud N. Pharmacy quality improvement project to enhance the medication management process in pediatric patients. *Ir J Med Sci* (1971-). 2019 May 1;188:591-600. https://doi.org/10.1007/s11845-018-1860-8
44. Muzauwir M, Fitriani AD, Lubis M. Analysis of the Implementation of Patient Safety Targets by Nurses in Installations in Regional General Hospital dr. Fauziah Bireuen. Journal La Medihealtico. 2022 Aug 22;3(4):327-42. https://doi.org/10.37899/journallamedihealtico.v3i4.694
45. Sullivan KM, Le PL, Ditoro MJ, Andree JT, Charest DJ, Tuiskula KA. Enhancing high alert medication knowledge among pharmacy, nursing, and medical staff. *J Patient Saf.* 2021 Jun 1;17(4):311-315. https://doi.org/10.1097/pts.0b013e3182878113