Medication Safety and Error Prevention in Emergency Care Settings

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Abstract : Emergency medication mistakes injure patients and endanger their safety. Medication error reporting systems exist; however, ED medication mistake rates are still a global issue, especially in high-stress emergency settings. In a tertiary care emergency hospital in India, researchers looked at how often pharmaceutical delivery mistakes occur, what kinds of errors occur, what causes them, and how to avoid them. From October 2017 to December 2017, researchers at India's tertiary care hospital's emergency department conducted a cross-sectional observational study. The research included adult patients (≥ 18 years) who received drugs during ED staff working hours. Trained investigators observed medicine administration mistakes (omission, improper time, dose, unauthorized, route, inappropriate method, expired drug, and dosage form) and gathered prospective data. Medical and nursing charts included demographic, pharmaceutical, and clinical data. The research involved 311 randomly chosen patients. This SPSS 22 data analysis included descriptive statistics and ANOVA. There were 311 patients with 130 medication mistakes in 95, a prevalence rate of 30.5% (95% CI = 25.3 – 35.7%). There were 56.8% more medication errors in the red zone than in the yellow (35.8%), or green (7.4%). The most common pharmaceutical mistakes included analgesics (49.4%), cardiovascular drugs (35.7%), and anti-infectives (29.4%). The most frequent errors were improper time (46.9%), unapproved (25.4%), omitted (18.5%), and dosage (9.2%). No adverse patient events were caused by medication mistakes in this research. These statistics imply that severely unwell individuals make most ED drug mistakes. Administration mistakes, including drug timing and illegal medicine use, were the most prevalent ED errors. Standardized procedures, double-check systems, and staff education may reduce drug mistakes and improve emergency department patient safety.

Keywords: Medication safety, Medication errors, Emergency department, Drug administration, Patient safety, India

INTRODUCTION

When a healthcare provider, patient, or consumer makes an avoidable mistake with a medicine that might lead to the wrong dosage or injury to the patient, it is called a medication error.

First, there is [1]. The Pennsylvania Patient Safety Reporting System, often known as PA-PSRSa, is a database that all healthcare facilities in the state of Pennsylvania are required to record any and all instances of medication errors as well. Instances that are considered to be serious include medication mistakes that are administered to patients and result in death or unforeseen injuries that need further medical services [2]. The repercussions of these uncommon but fatal errors may have a devastating effect on patients and their families, despite the fact that PA-PSRS only accounted for 0.4% (166 out of 46,568) of all pharmaceutical error reports in the year 2020.

In 2011, an investigation of the pharmaceutical errors that were reported to PA-PSRS in the emergency department (ED) over the course of a year was carried out [4]. Due to the fact that Even though the study spanned a whole year, researchers still couldn't pin down exactly how patients in the emergency department sustain injury due to pharmaceutical mistakes. An investigation of the major pharmaceutical mistakes reported to the Pennsylvania Public Safety Reporting System (PA-PSRS) in the ED from 2011 to 2020 was carried out so that we could have a better grasp of these incidents. In addition to this, we searched the available literature for alternative remedies that may reduce the number of instances in which these errors occur.

On the subject of ME, several studies conducted in hospitals have been conducted. Individuals who were included in these situations included hospital inpatient units [8–10] as well as outpatient clinics [5-7]. Additionally, the emergency departments are responsible for a considerable amount of research [11, 12]. There is a wide variety of specialties, illnesses, and medications that contribute to the substantial amount of labor that is performed in the emergency department (ED) [13]. As a result of these conditions, the setting of the emergency department is more likely to have pharmacological mistakes.

OBJECTIVES

1. To ascertain the frequency, kinds, and causes of pharmaceutical delivery mistakes among adult patients in an Indian tertiary care hospital's emergency room.

2. To improve patient safety in emergency care settings by identifying high-risk drugs and treatment areas and suggesting ways to reduce pharmaceutical mistakes.

RESEARCH METHODOLOGY

Study Design and Setting

Despite the study's length of one year, its researchers were unable to determine the precise mechanism by which pharmaceutical errors cause damage to emergency department patients. The purpose of this inquiry was to get a better understanding of the serious pharmaceutical errors that occurred in emergency departments and were reported to the Pennsylvania Public Safety Reporting System (PA-PSRS) between 2011 and 2020. In accordance with the triage-based strategy used by the emergency department, patients graded as red are regarded as critical, cases rated as yellow are regarded as semi-critical, and cases that are not deemed critical are classed as green. In the event that patients need monitoring for a short amount of time, an observation ward may be able to provide accommodations for them.

Study Participants

After being briefed on the objectives and methods of the research project, nurses and doctors working in emergency departments (EDs) gave their consent to take part. Participants who were eligible for the study were people who were at least 18 years old and who went to the on Sundays through Thursdays from 8:00 AM to 5:00 PM in the emergency department (ED). Excluded from the research were patients who did not receive medicine, those in the resuscitation area of the red zone, and those in the observation ward [14].

Data Collection Procedures

In order to obtain information in a prospective manner, trained investigators observed the process of administering the medication. During the course of the inquiry, the following errors in pharmaceutical administration were the primary focus of attention:

- **Omission errors:** Prescribed medication not administered before the next scheduled dose.
- **Wrong time errors:** Medication administered more than 1 hour before or after the scheduled time.
- **Dose errors:** Administered dose differs from the prescribed dose.
- **Unauthorized errors:** Medication administered without a valid prescription.

- **Route errors:** Medication given via a different route than prescribed.
- **Wrong technique errors:** Improper administration technique.
- **Deteriorated drug errors:** Expired or compromised medication administered.
- **Dosage form errors:** Medication administered in a form different from the prescription.

In order to get the demographic information and prescription lists of the patients, we used medical records. Additionally, we utilized nurse medication charts in order to obtain information on when, how much, where, and who dispensed the medicine. The observations were collected in a sequential manner for each of the three zones, which were red, yellow, and green. The experiment was conducted over the course of two weeks in order to lessen the likelihood of observer bias.

Sample Size and Sampling

It was determined that the sample size should be computed using the single proportion technique, with an anticipated percentage of medication errors of 75% and a significance threshold of 5% at a confidence interval of 95%. All of the eligible visits to the emergency department that took place throughout the course of the study period were used to choose 311 patients to participate in the experiment, which was conducted at random [15].

Data Analysis

When we were analyzing the data, we used SPSS 22 (IBM Corporation, USA). In order to determine the prevalence of medication mistakes, we divided the total number of patients who were included in the sample because they experienced at least one medication error. Percentages and frequencies were used as descriptive statistics to characterize categorical variables. Conversely, means and standard deviations were used to provide descriptive statistics for continuous variables.

RESULT

A total of 10,874 individuals went to the emergency room throughout the course of the nine weeks. From 8:00 in the morning to 5:00 in the afternoon, there were a total of 5454 people who arrived at the emergency department. Five hundred and forty-seven patients who fulfilled

the inclusion and exclusion criteria were the subjects of the data collection and observational studies. A total of 311 patient records were selected for the investigation using a random selection process. Within the entire patient population, men made up 53.7% and females 46.3%. With a mean (standard deviation) ranging from 44.02 to 18.39 years, the age range of these individuals was 18–84 years. This information is shown in Table 1. Late afternoon sessions had a greater number of patient visits than morning and early afternoon sessions [16]. This was in comparison to the early afternoon and morning sessions. During their visit to the emergency department, patients were diagnosed with a wide range of medical illnesses and were prescribed an average of 2.68 medications, with the number of medications ranging from 1 to 12.

Table 1. Patient demographics and clinical characteristics (n = 311)

Different factors	Rate (percent)	Summing up	significance level
Gender			0.192
Male	167 (53.7)		
Female	144 (46.3)		
Age (years)		44.02 (18.39)	< 0.001
18–25	77 (24.8)		
26–40	60 (19.3)		
41–60	113 (36.3)		
60+	61 (19.6)		
Ethnicity			< 0.001
Malay	282 (90.7)		
Chinese	12 (3.9)		
Indian	17 (5.5)		
Time of Visit			0.301
Start of the day (8 am to 12 pm)	108 (34.7)		
Middle of the Day (12–2 pm)	91 (29.3)		
Around two or five in the afternoon	112 (36.0)		

Triage			0.004
Red	84 (27.0)		
Yellow	131 (42.1)		
Green	96 (30.9)		
Having a Past Anxiety Phlebitis			< 0.001
No	278 (89.4)		
Yes	33 (10.6)		
Multiple Health Issues at Once			< 0.001
No	242 (77.8)		
Yes	69 (22.2)		
Drug Use at the Same Time			< 0.001
No	245 (78.8)		
Yes	66 (21.2)		
Medical Diagnosis Classification (ICD-11)			
Conditions affecting the blood vessels	69 (22.1)		
Infectious respiratory illnesses	62 (19.9)		
Injuries, toxins, and other uncontrollable external factors	56 (18.0)		
Diseases of the digestive system	25 (8.0)		
Diseases related to the endocrine system, diet, or metabolism	20 (6.4)		
Dermatological disorders	16 (5.2)		
Neoplasm	15 (4.8)		
Sexually transmitted diseases	14 (4.5)		
Disorders affecting the blood or organs that produce blood	9 (2.9)		
External causes of morbidity or mortality	9 (2.9)		
Musculoskeletal and connective tissue disorders	6 (1.9)		

Certain infectious or parasitic diseases	4 (1.3)		
Nervous system disorders	3 (1.0)		
Clinical manifestations, indicators, and symptoms not otherwise categorized	3 (1.0)		

Table 2 may be consulted in order to see the distribution of drugs according to treatment zone. According to the findings of the research, 130 of the 95 individuals had made errors with their medication [17]. There were a total of 30.5% of medication errors that occurred (95% confidence interval: 25.3% to 35.7%). It was shown that patients in the red zone had the highest incidence of medication mistakes (56.8%), followed by patients in the yellow zone (35.8%), and then patients in the green zone (7.4%). There were sixty male patients and thirty-five female patients that participated in the study.

Table 2. Pharmacological Dosage by Treatment Area

Treatment Area	No. of Patients	No. of Medications	Mean (SD)	F Statistics (df)	P value
Red Zone	84	362	4.31 (2.53)	57.95 (2, 308)	< 0.001
Yellow Zone	130	272	2.09 (1.18)		
Green Zone	97	201	2.07 (1.01)		

To compare the average number of drug administrations between zones, one-way analysis of variance was used.

Post hoc analysis:

- Red vs. Yellow: significance level ($p < 0.001$)
- Red vs. Green: significance level ($p < 0.001$)
- Yellow vs. Green: "Not significant" ($p > 0.950$)

The great majority of these people were diagnosed with cardiovascular and respiratory diseases related to their cardiovascular system [18]. Analgesics accounted for 42.1% of the total number of medications that were administered, cardiovascular medications for 43.2%,

antibacterial drugs for 29.5%, and gastrointestinal medications for 21.1% of the total. Table 3, which is organized according to the various types of ME, has a list of medications that have been shown to be linked with ME.

Table 3. Medication Error-Related Medications (N = 95)*

Medications by Class Prescribed	N (%)
Relieving Pain Medication	47 (49.40)
Drugs for cardiovascular health	34 (35.70)
Class I Antimicrobials	28 (29.40)
Drugs for the gastrointestinal system	20 (21.05)
Central nervous system medications	12 (12.63)
gout medication, anti-inflammatory, anti-rheumatic	7 (7.36)
Immunotherapy, antisera, and vaccines	5 (5.26)
Respiratory medications	5 (5.26)
Anesthesia and antimuscarinic agents	4 (4.21)
Hormones and endocrine products	2 (2.10)

It was discovered by the authorities that the individuals in issue had four separate sorts of drug mistakes. Table 4 [19] shows the distributions of the different types of medication errors. The Time errors were the most prevalent sort of pharmacological error, occurring in 61 instances (46.9% of all cases).It was determined that there were no adverse events that occurred as a consequence of medication mistakes throughout this time of investigation.

Table 4. Medication Error Types (130 MEs in 95 Patients)

Type of Medication Error (ME)	N	%
At the wrong moment	61	46.9
Unauthorized	33	25.4
Omission	24	18.5
Dose	12	9.2

Total	130	100

Note: Percentages are based on the total number of medication errors (130 MEs).

DISCUSSION

This research illustrates the significant prevalence of this problem in a busy tertiary care emergency department in India, where 35% of patients had faced a prescription mistake. Because of the large volume of patients, the intricacy of their diseases, and the time pressure surrounding their care, this research shows that high-acuity zones, like the red triage area, are more likely to have errors than normal. This is consistent with earlier research conducted in different parts of the globe. No statistically significant difference in risk was found between the sexes; nevertheless, male patients exhibited significantly higher mistake rates compared to female patients [20].

A major and avoidable mistake that happens in emergency departments, according to the study's results, is time. Inappropriate time administration was the most common sort of mistake, including 46.9% of all faults. Noteworthy omission mistakes (18.5%) and unlawful administration (25.4%) demonstrated a lack of communication, documentation, and policy adherence [21]. The results highlight the need of organized treatments that focus on areas and medicines that are known to have a high risk of adverse events. These areas and medications include analgesics and cardiovascular pharmaceuticals, which are often implicated in adverse events.

The study's results suggest that observation-based prospective monitoring may detect administration mistakes even when no side effects are present. Because medication delivery mistakes may pose an unseen danger to patients' health, the significance of careful monitoring cannot be overstated. Possible solutions to reduce the occurrence of these mistakes include maintaining electronic records of medication dispensing, implementing standardized procedures, verifying information using barcodes, and providing regular staff training. Another potential benefit of instituting a reporting and feedback culture is that it may encourage healthcare staff to identify and address near misses. It is possible that this culture may save little injuries from becoming major ones.

Although no adverse effects were found in this trial, there is still a good chance that something bad can happen, especially for high-risk patient populations and drugs that need rapid

administration [22]. It is likely that the total occurrence of medication errors was underreported for the sake of the study because of the research's limitations, which include its single-center design, monitoring during restricted working hours, and the exclusion of prescription errors. Research in the future should look at the impacts of multi-center setups and prolonged observation hours, as well as methods to decrease the amount of prescription mistakes.

CONCLUSION

When it comes to medicine distribution errors in emergency care settings, patients who are critically ill and located in high-acuity zones are more susceptible to accidents. Analgesics, cardiovascular drugs, and anti-infectives were the pharmaceuticals that were impacted the most often, with the most common errors being improper scheduling and administration that was not authorized. Patients are put in serious risk as a result of these errors, even if there are no immediate major effects that may be seen. It is proposed that certain actions be taken in order to enhance the safety of emergency departments and minimize the number of prescription errors. These efforts include educating staff members, standardizing processes, implementing double-check systems, and using electronic monitoring technology.

References

1. National Coordinating Council for Medication Error Reporting and Prevention. About Medication Errors. NCC MERP website. https://www.nccmerp.org/about-medication-errors. Published 2021. Accessed October 12, 2021.

2. Pennsylvania Department of Health. Medical Care Availability and Reduction of Error (MCARE) Act, Pub. L. No. 154 Stat. 13 (2002). DOH website. https://www.health.pa.gov/topics/Documents/Laws%20and%20Regulations/Act%2013%20of%202002.pdf. Published 2002. Accessed March 2, 2022.

3. Kepner S, Jones R. 2020 Pennsylvania Patient Safety Reporting: An Analysis of Serious Events and Incidents from the Nation's Largest Event Reporting Database. *Patient Saf*. 2021;3(2):6-21. doi: 10.33940/data/2021.6.1.

4. Medication Errors in the Emergency Department: Need for Pharmacy Involvement? *PA Patient Saf Advis*. 2011;8(1):1-7. Available from: http://patientsafety.pa.gov/ADVISORIES/Pages/201103_01.aspx.

5. Kripalani S, Roumie CL, Dalal AK, Cawthon C, Businger A, Eden SK, et al. Effect of a pharmacist intervention on clinically important medication errors after hospital discharge: a randomized trial. Ann Int Med. 2012;157:1–10.

6. Smith MD, Spiller HA, Casavant MJ, Chounthirath T, Brophy TJ, Xiang H. Outof-hospital medication errors among young children in the United States, 2002–2012. Pediatrics. 2014;135:867–76.

7. Al-Khani S, Moharram A, Aljadhey H. Factors contributing to the identification and prevention of incorrect drug prescribing errors in outpatient setting. Saudi Pharm J. 2014;22:429–32.

8. Hron JD, Manzi S, Dionne R, Chiang VW, Brostoff M, Altavilla SA, et al. Electronic medication reconciliation and medication errors. Int J Qual Health Care. 2015;27:314–9.

9. Ornato JP, Peberdy MA, Reid RD, Feeser VR, Dhindsa HS. Impact of resuscitation system errors on survival from in-hospital cardiac arrest. Resuscitation. 2012;83:63–9.

10. Guerrero-Aznar MD, Jiménez-Mesa E, Cotrina-Luque J, Villalba-Moreno A, Cumplido-Corbacho R, Fernández-Fernández L. Validation of a method for notifying and monitoring medication errors in paediatrics. An Pediatr. 2014; 81:360–7.

11. Rothschild JM, Churchill W, Erickson A, Munz K, Schuur JD, Salzberg CA, et al. Medication errors recovered by emergency department pharmacists. Ann Emerg Med. 2010;55:513–21.

12. de Andres-Lazaro AM, Sevilla-Sanchez D, del Mar O-RM, Codina-Jane C, Calderon-Hernanz B, Sánchez-Sánchez M. Accuracy in the medication history and reconciliation errors in the emergency department. Med Clín (Barc). 2015;145:288–93.

13. Eisenberg EM, Murphy AG, Sutcliffe K, Wears R, Schenkel S, Perry S, et al. Communication in emergency medicine: implications for patient safety. Commun Monogr. 2005;72:390–413

14. Ab Rahman A, Jatau AI, Aung MMT, Kamauzaman THT. Factors associated with drug-related emergency department visits at a teaching hospital in Malaysia. Pharm Med. 2017;31:175–81.

15. Shah CMS, Ismail IM, Mohsin SS. Ambulance response time and emergency medical dispatcher program: a study in Kelantan, Malaysia. Southeast Asian J Trop Med Public Health. 2008;39:1150–67.

16. Ministry of Health Malaysia. Emergency medicine and trauma services policy. Malaysia: Medical Development Division; 2012.

17. Tissot E, Cornette C, Demoly P, Jacquet M, Barale F, Capellier G. Medication errors at the administration stage in an intensive care unit. Intensive Care Med. 1999;25:353–9.

18. Bruce J, Wong I. Parenteral drug administration errors by nursing staff on an acute medical admissions ward during day duty. Drug Saf. 2001;24:855–62.

19. van den Bemt PM, Fijn R, van der Voort PH, Gossen AA, Egberts TC, Brouwers JR. Frequency and determinants of drug administration errors in the intensive care unit. Crit Care Med. 2002;30:846–50.

20. Ministry of Health Malaysia. Guideline on Medication Error Reporting. Malaysia: Pharmaceutical Services Division; 2009.

21. Naing L, Winn T, Rusli BN. Practical issues in calculating the sample size for prevalence studies. Arch Orofacial Sci. 2006;1:9–14.

22. 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;16:81–7.