

**A NARRATIVE REVIEW ARTICLE ON THE ROLE OF CLINICAL PHARMACIST IN
DETECTION AND MANAGEMENT OF MEDICATION ERRORS****Nafitha E.*, Dr. Lita Susan Thomas¹, Dr. Shijikumar P. S.², Dr. Sirajudheen M. K.³, Sherin A.⁴**¹Department of Pharmacy Practice, Jamia Salafiya Pharmacy College, Pulikkal, India-673637.²Department of Pharmaceutical Analysis, Jamia Salafiya Pharmacy College, Pulikkal, India-673637.³Department of Pharmaceutics, Jamia Salafiya Pharmacy College, Pulikkal, India-673637.⁴Department of Pharmaceutical Chemistry, Jamia salafiya Pharmacy College, Pulikkal, India-673637.***Corresponding Author: Nafitha E.**

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ABSTRACT

The aim of this narrative review is to study the role of clinical pharmacist in detection and management of medication errors. Medication errors is a night mare among the health care professionals. It leads to morbidity and mortality which in turn prolong the length of hospitalization. The frequency with which the various types of medication error occur and role of clinical pharmacist in detection and prevention of these error were evaluated in the study. Medication errors can occur at any stage of medication use, process, ordering, dispensing, administering or monitoring. The pharmacist, the prescriber and all health care professional must work together to ensure that patient achieve therapeutic out comes with safe and effective use of medication. The drug dosing, selection of drug regimen, uses and interaction of drugs, increased work load are found to be the cause of medication errors. All these error to be detected, reported and prevented by clinical pharmacist. A clinical pharmacist can initiate medication error reporting system which would improve the patient safety and visit the patient during pre-ward rounds and ward rounds of the prescriber to check bed side medication errors The medication errors were analyzed by medication chart review and the severity assessment index of national coordinating council for medication error reporting and prevention (NCCMERP). Therefore a clinical pharmacist can play a vital role in identification and prevention of medication errors by conducting awareness programmes for all the health care professionals and educate the public, minimizing the incidence of medication errors.

KEY WORDS: Medication Error, Clinical Pharmacy, Clinical Pharmacist, Patient Safety, Prescription Error.**INRODUCTION**

Drugs play an important role in health care system and contribute to significant improvement in outcome when used appropriately. However since drugs are frequently used, they are also one of the most common sources of error and adverse effects.^[1] The medication errors are the leading cause of morbidity and mortality, so they remained as confusing and undepreciated concept.^[2]

According to National Coordinating Council for Medication Error Reporting and Prevention(NCCMERP) defines "medication error is 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. Such event may be related to professional practice, health care products, procedures and system, including prescribing order communication, product labelling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use".^[3] Based on extent of outcome the NCCMERP classifies

medication error categories from A to IA-circumstance or events that have capacity to cause error and I- an error occur that may have contributed to or resulted in the patient death.^[4]

American society of hospital pharmacist's guidelines for medication errors stated that due to variations in different definitions of medication error or different method, the incidence of medication error is not exactly known.^[5] The medication error can occur at any stage of medication use, process, ordering, transcription, dispensing, administering and monitoring.^[6] There are mainly four type of medication errors are reported, Prescribing error (PE), Transcription error (TE), Administration error (AD), Dispensing error (DE).^[7] The medication error can increase morbidity, mortality, cost burden and also decrease the patient's confidence in the health care system. The illegible order, inadequate medical knowledge, and increased patient load particularly in teaching hospitals, failure to monitor drug concentration and therapy, and not having adjusted the

dosage of medication in renal or hepatic impairments these are the various factors that may induce medication error. They may affect the patient safety.^[8]

Incomplete patient information, unavailable drug information, miscommunication of drug orders, which can involve poor hand writing, confusion between drug with similar names, misuse of zeroes and decimal points, confusion of metric and other dosing units, inappropriate abbreviations, lack of appropriate labelling as a drug is prepared and repackaged in to small units, environmental factors, such as lighting, heat, noise, and interruptions that can distract health professionals from their medical tasks, which lead to medication errors.^[9] The drug related problems are major contributors to medication error and they are under reported and often goes unrecognized which lead to poor treatment outcomes and increased duration of hospitalization and increased cost of the treatment.^[10] Medication error can be caused by any cadre of health care professionals, patient and their care takers which play an important role and if neglected, can lead to medication nonadherence. Medication errors are categorised based on the severity according to NCCMERP.^[3] In order to prevent medication errors the clinical pharmacist can play an important role, who can timely detect and report thereby conforming the patient safety. The errors can be detected by an active management and proper reporting system there by encouraging safe use of medicines. An efficient communication is required between patient, pharmacist and other health care professionals which can reduce the incidence of medication errors. The clinical pharmacist ensuring safe and cost effective drug administration, monitoring and management of drug use pattern by providing drug information, training clinical pharmacy residents and using treatment guidelines for appropriate prescribing. Medication errors being a major concern to health care professionals who have been considered for reducing the number of errors and their impact on treatment of patients.^[11]

MATERIALS AND METHODS

Search Strategy

In order to conduct review of literature on medication errors we searched various electronic data base to find out the articles related to error in prescription, transcription, dispensing, administration and documentation. The following electronic databases were searched: Embase, Pubmed, Research gat, Scopus, the British Nursing Index, the Cumulative Index to Nursing and Allied Health Literature(CINAHL), web of science, Scientific information data base. Also manually searched references within articles to identify original information. Individuals of all age groups, different languages, and all types of study designs are included in this search strategy.

Search Terms

The medication error(s), prescribing error(s), dispensing error(s), administration error(s), documentation error(s),

transcribing error(s), medication mistake(s), drug mistake(s), prescribing mistake(s), dispensing mistake(s), administration mistake(s), transcribing mistake(s), wrong medication(s), wrong drug(s), wrong dose(s), wrong route of administration(s), wrong calculation(s), physician(s), pharmacist(s) and nurse(s). Role of pharmacist, role of nurses, role of physician, adverse effects, detection of medication errors, method of prevention of medication errors are used as search terms.

Inclusion Criteria

The study designs that have been considered for this study are as follows:

- Randomized controlled trials
- Non randomized controlled trials
- Clinical trials
- Longitudinal trials
- Cohort studies
- Case control studies
- Cross sectional studies
- Case report.

We searched for studies that have been reported types, definitions severity of medication errors, preventive measures and role of pharmacist in detection and management of medication errors.

Exclusion Criteria

The exclusion criteria includes,

- Letters
- Conference papers
- Organization reports
- Editorial papers
- Article on nursing practice error.

Review Procedure

From previous studies of medication errors, like article and journals the studies have been found to be heterogeneous. as they were conducted in different countries by using different definitions and different methods to collect data related to medication errors and role of clinical pharmacist in detection and management of medication errors. So here we did not try to analyze the data from a statistical viewpoint, but the results are summarized according to the type of medication errors.

RESULT AND DISCUSSION

The aim of this review was to review studies of the incidence and types of medication errors, to identify the main contributory factors involved and role of clinical pharmacist in detection and management of medication error. Medication errors are an important in determining patient safety. This review has shown that the scientific literature on medication errors published in various journals and articles. In this study included all aged patients but mainly focused on adult patients. the high rate of prescribing errors is known to be an international issue.

Mohammad Abbasnazari *et al.* says that total of 132 patients out of which there were 70 (53%) females with mean \pm SD of age 55.5 ± 18.4 years old and were evaluated for medication errors by clinical pharmacists. It is found that 262 errors were detected from 132 patients (1.98 per each) and managed appropriately. The frequencies of identified errors were as followed: wrong frequency 71 (27%), forget to order 37 (14.1%), wrong selection 33 (12.5%), drug interactions 26 (9.9%), forget to discontinue 25 (9.5%), inappropriate dose adjustment in renal impairment 25 (9.5%), under dose 16 (6.1%), overdose 15 (5.7%), lack of monitoring 14 (5.3%). Only few observational studies were done to assess the prevalence of medication errors within a teaching hospital in Iran. The rate of medication error per patient hospitalized in the intensive care unit (ICU) was in the range of 0.15 to 0.33. It is believed that the attendance of clinical pharmacist in medical care system can reduce the number of medication errors, maximized safety and lowered the health care costs. Cardiovascular agents were the class of drugs with highest frequency of errors in the present study. Concomitant cardiovascular disorders such as portal hypertension was common in cirrhotic patients admitted to gastroenterology ward also metabolic syndrome and consequently hypertension and hyperlipidemia are highly prevalent clinical entity among diabetic patients, in endocrinology ward. Therefore, the appropriate use of cardiovascular agents including beta blockers and angiotensin converting enzyme inhibitors that are necessary to manage these patients was an important concern in this study. In our study the most encountered errors were related to wrong frequency of medications especially for cardiovascular agents. After cardiovascular agents, the highest medication errors were observed in gastrointestinal medications. He says that their study was done in the gastroenterology and endocrinology wards also revealed a high number of medication errors that was prevented by the presence of clinical pharmacists. Some of these errors may even be life-threatening such as metabolic acidosis that can be precipitated by administration of metformin in end stage renal disease. In order to reduce medication errors and potential harms of these faults to patients we recommend that the attendance of a clinical pharmacist in all wards of hospital in collaboration with physicians and other health care systems is necessary in management of patient's diseases. Clinical pharmacists' attendance at the internal wards may help in detection and management of prescription errors therefore prevents patients from untoward consequences of various types of medication errors.^[12] The information regarding the pharmacist interventions to reduce incidence of medication errors are included.

Leap. *et al.* and Kucukarslan *et al.* found that the attendance of clinical pharmacist could help in lowering the adverse drug reactions and medication errors significantly. However, clinical pharmacists not only did not attend clinical rounds of gastroenterology and endocrinology wards but also they did not visit patients

hospitalized in these wards routinely. Therefore, this can potentially explain the higher frequency of medication errors in this study compared to what reported for ICU despite lower number of medications administered concomitantly in patients enrolled in their study.^[13,14] The information regarding the type of error that is being commonly found in the hospital are lacking.

According to a study by Kamal Boostani *et al.* says that during the study period, 100 patients (36 females and 64 males) with mean age of 63.5 ± 16.0 years old were randomly selected among 240 patients who had been admitted to internal medicine ward of our hospital during the 8 months. The total number of medications ordered to these patients was 1125. Two hundred thirty-three medication errors on 89 patients were identified by attending clinical pharmacist. It means that 89% of the study patients experienced at least one medication errors during their hospitalization. Most medication errors happened at the time of prescription by treating physicians (73.4% of errors) and the remaining was caused by nurses during transcription and drug administration (26.6% of errors). Interventions to correct medication errors were provided by clinical pharmacist when they were detected. The acceptance rate of the clinical pharmacist's interventions by treating physicians was 72.1% (168 out of 233 MEs). The most common medication errors occurred on cardiovascular drugs (26.6%) followed by antibiotics (21.9%), vitamins, minerals, and electrolytes (20.2%), and gastrointestinal drugs (13.7%). Total number of medication errors demonstrated a significant and direct correlation with the total number of ordered medications ($r = 0.48$; $P = 0.001$) and patients' length of in-hospital stay ($r = 0.26$; $P = 0.007$) but not with patients' age ($r = 0.044$; $P = 0.66$). Six medication errors were differently categorized by the internist and clinical pharmacist. Here the study was conducted in Iran and found that 89% of the patients experienced at least one medication error during their hospital stay which is lower than reported medication errors rates by other studies in patients admitted to internal wards. This can be potentially explained by the different setting of visits in internal wards, number of properly educated and skilled nurses, variety of patients' complaints, and absence of clinical pharmacists in clinical rounds or visits. Different factors including poly-pharmacy, co-morbidities, and altered drugs' pharmacokinetics may have contributed to higher frequency of medication errors in kidney diseases patients. Most medication errors (more than 70%) happened by the treating physicians at the prescription node and the remaining were errors at transcription and drug administration nodes caused by nurses.^[15] The information regarding pharmacist interventions to reduce the incidence of medication errors are lacking.

Breuker *et al.* says that, which aimed to evaluate the prevalence, features, and severity of medication errors and unintended medication discrepancies in an Endocrinology-Diabetology-Nutrition department in

France, 29.4% of the patients had at least one unintended medication discrepancy at admission or discharge and 98.2% of unintended medication discrepancies were considered as medication errors. The authors reported that 36% of patients experienced serious or very serious medication errors and almost 40% potentially moderate medication errors. In contrast to the study by Breuker.*et.al.* none of the medication errors in their study resulted in harm to the patients.^[16] Additionally, in an study by Vazin.*et.al.* says that on internal ICU patients in an Iranian teaching hospital, 89.4% of all medication errors were categorized as not dangerous to the patients. However, one patient death occurred in this study due to the serious prescription medication errors. Another study by Vazin.*et.al.* in the same setting reported that 25.3% of medication errors resulted in clinically significant harm to the ICU admitted patients.^[17] Diversity of these findings, along with higher rate of medication errors in their survey, might be related to differences in patient's care setting, definition and classification of medication errors, and methods or sources of medication errors detection. They haven't mentioned regarding the type of error that have been occurred more in the hospital.

Noguchi.*et.al.* conducted a prospective cohort study (JADE study) at 3 tertiary-care hospitals in Japan to investigate epidemiology of medication errors and adverse drug events in Japanese adult inpatients. They randomly selected 7 medical and 8 surgical wards among three included hospitals. 12.5% of the patients experienced medication errors during their hospitalization. Most of the medication errors (about 66%) happened at the ordering stage and the remaining respectively occurred at the monitoring (18.7%), administration (14%), and dispensing stages. The most prevalent medication errors among all errors were duplicated drug orders (39%) followed by prescribing the incorrect frequency or dose (13%). A large majority of medication errors by physicians happened at the prescribing stage (93.5%), whereas the medication errors by nurses occurred respectively at the monitoring (48.4%) and administration stages (44.5%).^[18] The information regarding most common occur medication error are included.

A 6-month Indian prospective interventional investigation was performed by Sinha.*et.al.* in general medicine wards of a tertiary care hospital and says that medication errors rate was 6.4% and involvement of nurses in the happening of medication errors was higher than treating physicians. Further, administration errors were more prevalent than prescription errors. They also reported that gastrointestinal drugs, particularly proton pump inhibitors, were the most involved drugs in the occurrence of medication errors. Majority of the errors belonged to errors with no harm category. 90.6% of clinical pharmacists' interventions were accepted by corresponding health-care professionals.^[19] The information regarding drugs which induce medication error are included.

Leape LL.*et.al.* says that Over the past years, hospital pharmacists' clinical services have been provided to wards by performing daily ward visits and addressing any medication-related problems identified with proper interventions. The pharmacists' role in prescribing stage has usually been retrospective that this may cause a long delay between the prescription time and their intervention, leading to increased risk of occurring costly adverse drug events. Thus, it seems more beneficial for pharmacists to attend at the time of prescription and provide specialized knowledge as it is needed.^[13] The information regarding the level of severity of the medication errors are lacking.

According to Muhammad Umar Khayam.*et.al.* says that this study was conducted with aim of identifying potential medication errors with their prevalence in pediatric ward, the role of clinical pharmacist in preventing medication errors was also investigated, during this study period of 3 months, total 136 medication errors were encountered in 200 medication orders. Two physicians were involved in prescribing medicines. Different factors contributing to overall medication errors were closely monitored i.e age of the patient, type of medication prescribed, dosage form and route of administration. Majority of the patients were males (70.59%). Among the identified errors, prevalent error found was dosing error (27.21%), followed by incomplete prescription error (22.29%). Drug dosing, choice, use and interactions were the most frequent causes of error in medication processes, respectively. All of these errors were detected, reported, and prevented by pediatric ward clinical pharmacists.^[20] The information regarding medication error in pediatric studies are included.

Hossein Khalili.*et.al.* says that during the study period, clinical pharmacists monitored drug therapy and reviewed medical records of 861 patients (450 men and 411 women). The patients' mean of age was 42 ± 22 years old, and mean of hospitalization duration was 17.3 ± 5.6 days. Main causes of the patients' hospitalization were tuberculosis, HIV-related opportunistic infections, respiratory tract infections, soft tissue infections, osteomyelitis, pyelonephritis, brucellosis, abscess, and endocarditis. Mean numbers of prescribed drugs for each patient during hospital stay were 6.6 ± 3.4 drugs that 2.9 ± 1.5 of them were injectable dosage forms. Antibiotics (3.4 ± 1.1), acid suppressants agents for stress ulcer prophylaxis, anticoagulants for deep vein thrombosis prophylaxis or treatment, anti-inflammatory drugs, analgesics, sedatives, fluids, electrolytes, insulin, oral hypoglycemic agents, and supplements, respectively, were the most prescribed drug classes for the patients during hospitalization in this ward. Clinical pharmacists detected 112 errors among 861 patients that admitted to infectious diseases ward of Imam Hospital during the study period. Mean number of medication errors per patient was 0.13. Numbers (percent) of each type of medication errors were as follow: dosing 44 (39.3%),

choice 44 (39.3%), use 22 (19.7%), and interaction problems 2 (1.7%). In evaluation of the medications errors origin, physicians were responsible for 55 (49.1%) of the detected errors in medication processes. Nurses are involved to the 54 (48.2%) of the medication errors, whereas patients were responsible for 3 (2.7%) of them. All of these errors were detected by clinical pharmacists, and they made recommendations about these errors. These recommendations were accepted by the health care provider team responsible for the patients' drug therapy. Studies have shown the benefit of pharmacist's interventions in improving patients' outcomes by involving in the health care team rounds, interviewing patients, reconciling medications, and providing patient discharge counseling and follow-up.^[21] The information regarding the level of severity of the medication errors are lacking.

Sandip Patel *et al.* says that, mean age of the patients included in the study was 49.21 ± 18.13 years and 49.22 ± 18.18 years in medicine ward and surgery ward, respectively. Age group between 41-60 years, 68 (34.69%) had the higher number of medication errors. Majority of medication error was observed with IV route (112; 57.14%) followed by oral route (55; 28.06%). Majority of medication errors was observed in male (109; 55.61%) followed by female (87; 44.38%). In addition, the majority of the medication errors were due to drugs of cardiovascular system (23; 23.71%) followed by antibiotic drugs (21; 21.64%) in medicine ward and gastrointestinal drugs (29; 29.29%) were highest in the surgery department. During the study periods, total 99 cases were collected in the surgery department with medication errors. Out of them, 33 (16.83%) cases were found in gastrointestinal surgery, 32 (15.81%) orthopedic surgery, 12 (6.12%) CVS surgery, 12 (6.12%) renal surgery, 2 (1.02%) dermatology surgery and 8 (4.08%) respiratory surgery. According to him found that The total number of errors found was 196, among which prescribing errors (138; 70.40 %) were the most frequently occurring type of error, which was followed by administration error (58; 29.59%) . Among prescribing errors, omission of drug dose (104; 53.61%) is observed at larger extent. Whereas among administration errors, omission of drug (55; 28.06%) and wrong time (3; 1.15%) were common. Out of 196 observed medication errors, 95 (48%) had the DDIs. The majority of DDIs was minor 37 (18.87%) followed by a significant 30 (15.30%), while 28 (14.28%) DDIs were serious. Medication error index of NCCMERP was used to assess the severity of medication error. It was found that the medication error belonged to the category error, no harm which comes under the sub-category B 44 (22.44%) and sub-category C 118 (60.20%) followed by 34 (17.34%) in the category no error which comes under the sub-category A. The other levels of severity such as error harm, Error Death were not identified during the study period^[22]. The information regarding occurrence of medication are lacking.

Solanki ND *et al.* reported that the overall percentage of medication errors observed in our study was 45.90% without causing any harm to the patients, whereas a study conducted in a multispecialty hospital detected 39% of medication error without any fatal outcome.^[23] The similar results were reported by Patel *et al.* On the contrary, Pote *et al.* reported that more than 60 years was more affected by medication errors. Our study demonstrated that the IV route of administration was involved in medication error which is supported by Ross *et al.* In Pediatric department and Patel *et al.* tertiary care hospital.^[5,24,25] This finding suggests that medication errors are commonly associated with IV route.

Honiden *et al.* says that, the pain goals should be individualized to meet the needs of each patient, and for being subjective, the most reliable evaluations require the active participation of the patient. Among patients who cannot communicate, the pain can be inferred from observable behavior through the aid of instruments such as "Behavior Pain Scale" or "Critical Care Pain Observation Tool", but there are limitations due to interpretation. The patient was receiving two drugs of similar action mechanism, metoprolol and labetalol, which could accentuate the adverse effects of these drugs, in addition to increasing the likelihood of a hypotensive crisis. The perception by the clinical pharmacist and the acceptance of pharmaceutical intervention on the same day may have avoided such drug therapy problems. Bleeding occurs because at the time of ICU admission, the patient feels stressed, cornered and there is activation of the sympathetic nervous system, with increased release of catecholamines and procytokines, which in turn will leads to displacement of blood from the gastrointestinal (GI) tract to organs related with escape, such as muscles and brain. When prolonged, this gastric hypoperfusion and consequent reduction in oxygen supply decrease the secretion of bicarbonate and mucus in the stomach, besides reducing gastric motility. These effects of the GI tract, make it more susceptible to the corrosive action of pepsin and other bile acids, leading to ulceration and constant degradation of formed clots. Once the ulcer is formed in a patient at ICU, the probability of sepsis or multiple organ failure is imminent, may lead him to death. Therefore, to prevent the worsening of a clinical picture to this point, prophylaxis is the most effective way. In these cases, cimetidine remains the only H₂-receptor agonist approved by the Food and Drug Administration (FDA) for the prevention of gastrointestinal bleeding in critical care patients. The scheme approved by the FDA is 50 mg/h IV continuous infusion, however, in practice, intermittent bolus infusion is more used. A comparative study of continuous IV cimetidine versus oral omeprazole resulted in a significant reduction of gastrointestinal bleeding with omeprazole compared with cimetidine. Therefore, prevention is done with the use of proton pump inhibitors.^[26] They haven't mentioned regarding the

incidence and occurrence of error that have been occurred more in the hospital.

CONCLUSION

Majority of the patients admitted to internal medicine wards experienced medication errors in which the prescription error is the most frequently occurred due to prescriber. The pharmacist play an important role in the detection and management of medication error. The accurate prescription written by prescribers and prescription screening by the pharmacist can reduce the incidence of medication errors. Education and training programs on drug therapy are required for the public, pharmacist, doctors, nurses and all other health care professionals and also an effective communication between clinical pharmacist and other health care professionals can reduce the incidence of medication error and thereby enhance the patient safety.

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ABBREVIATION USED

NCCMERP: National Coordinating Council for Medication Error Reporting and Prevention, **PE:** Prescribing Error, **TE:** Transcription Error, **AE:** Administration Error, **DE:** Dispensing Error, **FDA:** Food and Drug Administration.

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