A REVIEW ON CLINICAL PHARMACY SERVICES

Dr. Gaurav Joshi*a, Ms. Roshmi Ray**a, Mr. Nishant Goutam*b, Ms. Alka Sharmab

a*Department of Clinical Pharmacy Practice Pharm D, University Institute of Pharma Sciences, Chandigarh University, Gharuan-140413, Kharar, Punjab.
a**Department of Pharmacology, University Institute of Pharma Sciences, Chandigarh University, Gharuan-140413, Kharar, Punjab.
b*Department of Pharmacology, Laureate Institute of pharmacy, Kathog-177117 Jawalamukhi, Kangra, H.P.
bDepartment of Pharmacognosy, Laureate Institute of pharmacy, Kathog-177117 Jawalamukhi, Kangra, H.P.

ABSTRACT

Drug related problems have always been an issue to be solved in the system which is needed to be identified, prevented and resolved at an early stage. The need of a clinical pharmacist also becomes crucial. He is the one who can not only share the load but can be a major part of the system for their advice which is needed. They complete patient information form focussing on pharmacotherapy monitoring and reporting of drug-related complications to physician or doctor. Serious ADR are reported by general physicians annually. Due to all these, the availability of a clinical pharmacist in and around the healthcare service is meant to develop the pharmacy field. A therapy and medications involved in it can enhance the quality of life in terms of health and also cures, prevents or diagnoses a disease, sign or symptom. But the other side shows drastic damage as well. The demand has now led to the rise of clinical pharmacy because of the services they provide. A detailed research study related to clinical practices and patient consequences is required to evaluate the impact and advantages of the ED clinical pharmacist. The competence of a clinical pharmacist in different fields like, pharmacology, pathology and toxicology add up to the therapy compliance by the patient in a much better way. It has become necessary to observe the weak areas of healthcare systems and the people involved.

Keywords: Emergency services, Patient Counselling, ADRs, Medication Reviews, DRPs


INTRODUCTION

As the more burden of dispensing and counselling is increasing day by day and the demand-supply target is becoming trickier, the pharmacists are getting more exhausted. This attracts more druggists who can be involved to play the role in clinical pharmacy being in the healthcare system. The demand has now led to the rise of clinical pharmacy because of the services they provide. Therefore, it has become a necessary and indispensable part of the healthcare system where it has got an important stage in this multidisciplinary setup. Pharmacists play a crucial role by educating and encouraging the care for the patient by counseling the patient as well as communicate with the prescriber. Clinical pharmacists are the ones who cover-ups the gap between the medical practitioners and their patients as they have an accurate knowledge of medication and treatment plan. Thus, the collaborative work of clinical pharmacists and the physicians can build a strong pillar for a quality service to
their patients. Due to all these features, the clinical pharmacist available in and around the healthcare service is for the development of pharmacy field.1

In the present society, it is thought that a qualified person who can treat patients is titled as a doctor, physician, clinician, medical practitioner, etc. Also, these are the people who achieve a degree of medical or allied health, who can improve the healthcare system and can support the medical system by their advice. Such a system is too important for the development of any country. People consider these people to be the best as they guide the healthcare system which needs perfection and improvement day by day. Thus, the need for a clinical pharmacist also becomes crucial. He is the one who can not only share the load but can be a major part of the system for their advice which is needed to cure, treat or even save a life.2

Drug-related problems have always been an issue to be solved in the system which is needed to be identified, prevented and resolved at an early stage. The issue is not new to any therapy. Other terms have been suggested, for example ‘problems associated with drug-therapy’ can also be considered, and this term was coined by the team of Cipolle, Morley and Strand. In the year 2002 Krska proposed the name “Pharmaceutical Care Issue”.

Pharmacotherapy failure, also corresponds to misuse or non-adherence to the therapy; resulting in undesirable clinical responses.3

Many attempts have been put forth to optimize the rational usage of drugs and medical preparations, still, various reports have come forward which enlists drug-induced problems. Many factors may play a role in such cases, like social pressure on the physician, the law and system of healthcare services and the marketing strategies of pharmaceuticals. Another important role is played by the patient itself. Polypharmacy and larger usage of drugs are some of the reasons for creating such issues which do not follow the principles of pharmacotherapeutics. Such issues are then categorized as Drug-related Problems (DRPs).4

It is accepted that a therapy and medications involved in it enhances the quality of life in terms of health and also cures, prevents or diagnoses a disease, sign or symptom. But the another side shows that an improper usage of those drugs can cause a major damage by creating new adverse situations, be it morbidity or mortality.5,6

Therapy-related problems are seen to be common and errors related to medication were expressed from 15 to 35% of all doses provided to the patients under hospitalization.7

These errors are considered to be responsible for therapy expenses and around 6.5% of death rate of hospitalized person is in close relation to such errors where it has been observed that two-thirds of those events were preventable.8

The drug therapy delivered by the clinical pharmacists in the hospitals allows different aspect of patient safety, which can minimize the risks potentially associated with such errors.9, 10

Though few reports on the advancement in drug therapy error management by involving clinical pharmacist are there, still there is poor knowledge in some of the developing countries. A clinical pharmacy residency program was first initiated in Iran in the year 1994, and till now, more than one hundred clinical pharmacists got graduated.
Most of them are academicians and performing their duties with the doctors and other healthcare team members in the hospitals. Medication review by the pharmacists in the hospital setting is in advanced stage due to the involvement of clinical pharmacists along with the health care team. Reviews of medical charts by pharmacists are considered as their routine responsibilities. They complete patient's drugs therapy history and monitoring form and report drug-related complications associated with therapy to head of the medical team.11

For an optimum result in a complex situation it is required to have an emergency system, diagnostic procedure and clinical therapy for sufficient availability of antidotes, supportive services and the best knowledge for managing the clinical studies. A multidisciplinary team shows better results when compared with a monodisciplinary team. (12).

Correct antidote at the correct time and also with correct knowledge and skills results only from a system competent to take right decision in the give circumstances. Emergency departments have several cases every year, but only a few of these cases exist. The reason behind this is perhaps the medical equipment with multi-professional expertise. Antidote is not a simple drug. It portrays in-depth knowledge about the pharmacokinetics and pharmacodynamics of a single patient. Clinical pharmacy, Toxicology, and management of antidotes are few disciplines which are co-related with toxicological medical teamwork. Such a system needs interdisciplinary equipment such as toxicologist working in lab and clinic, along with the pharmacist, ICU team and other paramedical staff like as dialysis experts; Hospital pharmacy and pharmacists play a similar role here.13

TDM helps in the valuation of the safety and efficacy of a particular drug regimen or medication in different clinical settings by blended knowledge of different subjects of pharmacy like pharmacokinetics, dynamics and pharmaceutics.14, 15

Now, the determination of Pharmacokinetic parameters by measuring the blood concentration of the drugs has been made much easier by developing the modern analytical technique. Such parameters provide worthy information of a medicament by assessing it clinically. Therefore, TDM is a tool that guides a medical practitioner for providing safe and effective treatment to an individual patient. Further, better monitoring can confirm plasma-drug concentration which is above or below a therapeutic range.16

The major factor which contributes to life-threatening events is considered to be the adverse-drug reactions. This imposes a negative effect on the quality of life and exerts large expenses on the healthcare systems. ADRs with medication errors are the fourth cause of mortality in the United States.17

An astonishing data shows that the deaths due to medication errors and ADRs are much higher in number than the deaths caused by highway accidents, breast cancer and AIDS.18

Also, it has been reported that around 7% of hospitalizations are the results of ADRs.17, 19

Economic consequences resulting from ADRs are also significant. In Germany, it has been estimated that the direct cost of medical complications during 13 years was 588 million dollars each year, of which 30.7% were preventable.20
ACTIVITIES

Medication Review and Counselling

It is already known that an increased number of medications can directly or indirectly lead to the hospitalization of an individual. According to the Pharmaceutical Care Network Europe (PCNE), a DRP (Drug Related Problem)“is an event or circumstance involving medication therapy management that potentially causes obstructions to achieve the desired health benefits”. Errors in medication and ADRs are much common types of DRPs in case of hospitalized patients and may also create reasons of patient morbidity and mortality. PCNE, and Apoteket AB (National Corporation of Pharmacies in Sweden) are the most commonly used classification systems for DRPs. PCNE classification system has a extensive context and covers the areas such as process-related factors, patients’ acquaintance about health and diseases as well as administrative problems in totality. Cronbach's alpha has stated the correct definition of PCNE which is found to be 0.477 for the current set-up. DRPs can occur throughout the entire therapy steps and may bring in notice all the risk factors associated with adverse drug reactions and events.

In the recent past, the drug-induced morbidity has quite often been related to adverse drug reactions, still these occupy a small portion of DRPs. Clinical pharmacists are the experts who can co-relate diagnosis, laboratory interpretations, medication history and prescription with the current disease management aspects of an individual patient. Therefore, this is mandatory to appoint clinical pharmacist in health care association as he can minimize the several episodes of DRPs better than an artificial system can such as CPOE (Computerized Physician Order Entry systems) and CDSS (Clinical Decision Support System).

Lots of studies have reported that the role of a clinical pharmacist is much crucial which offers better service for patient care. In one of the research report, the occurrences of DRPs were interrelated with the demographic, medication, and number of comorbidities which are responsible to increase in DRPs. Hence the main objective of clinical pharmacist is to identify, assess and prevent DRPs in drug therapy given to geriatric patients. They also concentrated on poly-pharmacy condition which is the leading cause to DRPs. Hence it can be stated that, patient age, poly-pharmacy and other severe diseased states are the main factors leading to DRPs. In cases where age-related DRPs are related most of the patients associated with DRPs comes under geriatric age group. Maybe due to over prescriptions prescribed in this group. This was followed by as an increase in age group of patients, the number of DRPs and the numbers of medicaments prescribed were ultimately increased based upon the disease condition of patient. And this age group shows an increase in number of co-morbid conditions which is on the top among other population groups. The reason behind this can be the inadequate knowledge about the disease, other fatal causing conditions, and polypharmacy. Hence with increase in age group of patients the chances of occurrence of DRPs will also be increased. Because as the progression of age, co-morbid conditions will also increases and as a result polypharmacy should be prescribed, which in turn lead to an increase in DRPs.
The main reason behind the drug-drug interactions is a direct relationship between the numbers of drugs prescribed in a single time and the DRPs. Most of the major and significant drug-drug interactions are observed in the geriatric age group of patients, out of which few must be intentional/beneficial. Drug-drug interactions can alter the response of drugs, leading to either sub-therapeutic or supra-therapeutic dose. Therefore, to minimize the episodes of drug-drug interactions, pharmacokinetics and dynamic parameters of a drug should be understood properly; as DRPs are mostly dependent on chemical and physical characteristics of the drug and that is why these are often more difficult to prevent. To prevent drug interactions, initially, we focused on the pharmacokinetic properties of each drug. Such interactions are serious and are needed to be observed and monitored often. Otherwise, alternate therapy plans should be prescribed to minimize episodes of interactions in patient, by avoiding the interaction by replacing drugs with their substitutes. When these plans are executed and administered, the drug interactions are presented in a better way and optimum treatment can be provided to the patient as well.

**Therapeutic Drug Monitoring**

TDM data is a method to determine by a clinician, how a patient responds to a particular therapy and studying the factors playing for the same. For example, when a therapy failure occurs due to poor response of a patient then the quantitative analysis of plasma level can help to reveal which person is truly abiding by the instructions and which patient is noncompliant. The method also gives information about individual responses to drug consumption patterns and modification in drug utilization as a cause of altered physiological state. An important point of TDM is to find the dose-response relationship, its affectivity, rationale, etc. In a country like ours, it may seem to be of less or no use and maybe unwanted as many factors are involved such as medical care, lack of awareness by patients, expenses, poor financial support, lack of infrastructure (e.g. in villages and primary health center), where it may seem to be an extra burden. When value and quality of life are considered, this TDM is much acceptable and needed for a few categories of drugs. The governmental bodies and regulatory agencies can note such a category for TDM to be carried out. The actual matter of TDM relies on the estimation of drug concentration in the body fluids like saliva, plasma, serum, etc.

If the drug has a dose-response relationship, the TDM can be highly useful in providing a beneficial service. But for the drugs which do not obey the dose-response relationship or facts such as personal variations, special variations or racial variations (e.g. slow acetylators, fast acetylators), the reporting of blood concentration may not be any value or even may complicate the therapy. For certain categories of drugs, where the metabolite is also active the TDM assay has to be carried for both the administered drugs and its metabolite. It has been observed that therapeutically low concentration of drugs in few patients than the standard dose is very effective and in few patients a higher concentration is required than the standard range of serum concentration without showing any toxic effect and giving a satisfactory result. But such situations may state those higher doses to be toxic concentration which may add unwanted anxiety bringing a cause to lower the dose. A better way is to consult a physician and clinical pharmacist to get a better conclusion by approaching a team discussion. In few cases, where the condition is critical and requires emergency support, TDM is best needed and if the reports of the same are made available within a short duration then TDM proves to be very useful. For neonates and pregnant TDM can also be of use. During pregnancy, physiological changes are common like increased renal...
function, increased cardiac output, increased placental blood flow, variations in the concentration of plasma proteins, hormonal changes, etc. Since, drugs are prescribed to maintain and support good health and ill situations during pregnancy. Such drugs may be capable enough to cross the placental barrier and cause toxic effects to the fetus, therefore, TDM is necessary. This method is also important for neonates during their treatment, but many issues are also observed in them. For example, many drugs have to be initiated immediately without a history of any clinical data of the neonate. In such emergencies, the benefits of drugs are valued than their toxic effects like jaundice, etc. Moreover, the collection of samples, correct time of administration of drugs, their response to drugs, the presence of drugs in the body, that are received through the placenta or the exposure of the body to drugs in the fetus, can also come in the way of TDM of neonates. In such cases a consolidated effort of the clinical team would provide more benefits and justification.

As far as expenses are concerned, the drug level measurement in body fluids must be cost-effective. The expenses involved in carrying out a particular test are based up on the cost of equipment involved, personnel, supply and other expenses. Then dividing that amount by the number of analytical tests performed in the same duration. The total charges are then fixed by adding desirable profit with the test's cost. 29

In therapeutic drug monitoring services if clinical pharmacokinetics is used, it presented various significant benefits like lesser ADRs, lower ICU stay and shorter duration of stay at hospital resulting in lower financial burden. 30

As discussed earlier, TDM may seem to be of less use in our country but when special therapies are taken into consideration, it comes out to be of great value providing effective service. The method is powerful in treatment measures when failure of a therapy or harmful effects is considered. It requires a combination of pharmaceutical, pharmacokinetic and pharmacodynamic techniques. Proper usage of the system needs more than a simple measurement of drug level in blood and comparison to the standard range. It also improves the safety and effectiveness of a medicament in an individual. Also, it helps to identify problems in noncompliant patients. Factors that are required to be kept in mind include the time of sample collection after dose administration, the dosage history, response of patient, and the desired clinical objectives to provide patient oriented disease management. 31, 32

Adverse Drug Reactions

A crucial finding of one of the studies showed a significant improvement in ADR reporting after education and the establishment of Pharmacovigilance Committees in the hospitals. It is interesting that despite sending the documents, posters and pamphlets of the IADRMC since 2004, the number of ADRs was very low from 2004 until 2007. Although the author observed an increase in the rate of ADRs after 2007, an important aspect of the experience was that the frequency of reports was not so satisfactory (i.e., underreporting). According to World Health Organization (WHO) definitions, countries with "Good reporting rate" report more than 200 reports of ADRs per one million people annually. 33 Thus, healthcare providers in Mazandaran province with 2,500,000 people should report at least 500 ADRs annually to be classified as "Good ADR reporters". Although there was a significant increase in the number of reported ADRs in 2009 and 2010 (229 and 237, respectively), it has not yet reached 50% of the number needed to consider Mazandaran health care providers as "Good reporters". On
the national scale, we observed a similar problem. According to the reports of IADRMC.34 and the total ADRs received by the national center were 4,511 in 2008 and 4,977 in 2009. Under-reporting is seen as a general drawback of the spontaneous reporting system, still, there are countries with acceptable reporting of ADRs, such as Australia and France. Around 12,000 ADRs are reported each year in Australia with a population of 20 million.35 In France, 210,000 serious ADRs are reported by general physicians annually.35 According to the previous studies, there are several causes for the under-reporting.36, 37 In the study of Ghasemian et al., which involved physicians, the national center not being aware, the absence of serious drug reactions and doubt about the causality relationship between the reaction and suspected drug were mentioned as the most important reasons.36 Similar reasons were proposed by pharmacists and nurses.37 Based on the above study, Antibiotics were marked as the top drugs that caused ADRs (45.4%) and the most common antibiotic-associated with ADRs was Ceftriaxone with side effects such as rash, hives, and anaphylactic shock. This pattern is similar to data reported by IADRMC.38 Technically, high amounts of Antibiotic-associated ADRs are often related to the high usage of drugs, both in the country and outside the country. More than 50% of the patients consuming antibiotics are observed visiting physicians; this rate increases to 59% for general physicians.39 Nurses reported more ADRs compared to physicians and pharmacists. The cause is assumed to be due to their close contact with both the physicians and the patients and management of drug administration of those patients. It is notable that in some countries such as England, Nurses were not allowed to fill out yellow cards until 2002. By relating all the previous studies an experience showed the role of nurses in the pharmacovigilance system.40, 41 In a study, 73.9% of ADRs were related to injectable drugs. The role of injectable drugs-related ADRs was more than expected through the previously submitted reports (53%).34 According to the reports published by the "National Rational Drug Usage Committee" in 2008, 45% of prescriptions consist of at least one injectable drug.42 Such ADRs can be avoided by avoiding unnecessary injections. As the injectables are not always necessary to provide effective results and due to the higher expenses and severe and immediate adverse reactions, it is likely to opt for oral drugs whenever possible to reduce the highest risk of ADRs of injectables.

**Medication Review**

Errors related to medication are quite often and is an important factor to be determined for patient care and safety. Therefore, it is necessary to observe the weak areas of healthcare systems and the people involved. According to reports of various studies, the intervention of a pharmacist is beneficial in encouraging proper therapy compliance, interviewing patients, reconciling medications and in counseling patients for proper follow-up.43, 44

Therefore, clinical pharmacists are required to participate actively as a member of healthcare team in teaching hospitals as well. Their primary responsibility is to monitor drug therapy, review patient medical records, attending in ward rounds, and educate other health care workers about disease management by pharmacologically as well as non pharmacologically. This outcomes of the drug therapy care provided by clinical pharmacists is new to the hospitals.45

Medication errors may also be a reason to cause infectious diseases. Frequency of the errors may vary depends upon patient demographic details or disease and medication history in past and present.46
Another similar study focused the attention on the errors of medication by reporting it in severe situation of patients. 47

The most common errors were observed due to improper dosing of drug and therapy choice complications. Reasons of medication errors in a paediatric wards maybe due to wrong dose adjustment to that patient.48

Out of all the most common medication errors should be omission errors, errors of wrong dose of a drug and wrong time.49

The high possibility in the occurrence of drug therapy errors may be due to paper-based orders in medical records along with computer based registration of medication, unavailability of medical records for pharmacists in the hospital pharmacy, patient overload in teaching hospital, and consequently increased workload of healthcare workers and unavailability or lack of therapy or disease management guidelines.50

Different types of definitions and classifications of medication errors, and the various theories behind data collection methods and reporting system are few of causes for differences between frequencies of medication errors. And also, the level of professionalism, personal techniques of work performance, and individual social skills of the involved health care workers may influence the duration and type of the medication error. Mediations of clinical pharmacist’s services in the whole patient care process beginning from dispensing of drug to administration to the patient can minimise episodes of drug therapy errors and to be beneficial to patient care.51

This achievement is only due to by participation of clinical pharmacist in special medication ward rounds and observing and analysing different steps of pharmaceutical care. Hence the main role of emergency department pharmacists is to reduce potentially harmful medication errors caused by any of factor.52

For the medication errors, it was found that in geriatric patients numbers of administered drugs had no significant effects but prescription of non-antibiotic drug classes most probably shows risk factor associated with patient demographic or disease and therapy. Although the interrelation between the duration of drug therapy errors and episodes of administered drugs have not found it as a risk factor.

**Toxicology**

Poisoning is often seen to be a rare experience, but in some cases have shown critical responses and therefore, a correct interpretation and therapy is required. It is said that the toxicology medical equipments should be multi-professional. Antidotes are used usually, and physicians search for rapid information in the field of medicinal chemistry and toxicology. Thus, the system must involve clinical pharmacists. The pathology, toxicology, pharmacology and medicinal chemistry proficiency of clinical pharmacists added to the emergency and ICU physician's competences can be the right keywords. Toxicological skills required to the clinical pharmacist to works with the toxicological health care workersto learn about the reason and management of therapy errors, critical thinking, collaborative approach, management ability, problem-solving risk management, therapy errors management like illegible handwriting, to achieve more inclusion of clinical pharmacist in the toxicologist equip also psychological and behavior-specific skill are useful equipments in management of toxicity caused by given drug therapy.54
Protocols

Now, it has become a basic necessity for an effective healthcare system to involve clinical pharmacists for their expertise. Pharmacist are being appointed for inspecting and monitoring the patients in critical care units which is fruitful to analyse the inaccuracy of therapy and to effectively eliminate the risks of adverse effects which occurs due to polypharmacy, etc. The participation of a pharmacist in medical rounds can be of great benefits in reducing the risk of adverse drug events.

As already discussed; pharmacist intervention is of utmost importance regarding doses, dosage form, frequency, start of a new therapy, choice of a drug for the well being of a patient. Another study stated that clinical pharmacist who provides pharmaceutical care for elderly patients also plays the most significant role in reducing the inappropriate prescribing and possible adverse drug effects also improving the quality of life.

The intensive care unit (ICU) pharmacists are essential healthcare team members in a multidisciplinary ICU. Directly or indirectly, they play a role in minimizing cost of therapy, arrange proficiency in individualized pharmacotherapeutic care, and serve an important informational function.

OUTCOMES

Most of the benefits of emergency department pharmacists relate to the responsibilities explained above. In most cases, patients advancing to the ward have been observed by the emergency department health care workers and a report was passed to the head pharmacist to review the reasons and what possible steps have to follow to minimize therapy related health issues. This is a time consuming process during this time interval ward pharmacists will be available to perform other clinical services. Adverse drug reactions (ADRs) reporting and therapeutic drug monitoring (TDM) are some of activities which are difficult to perform in emergency department without the presence of an ED pharmacist. The benefits of initiating therapeutic drug monitoring and early interventions are possible. Without presence of an ED pharmacist, patients would not gain the same level of discharge counseling about medications and discharge therapy plan.

CONCLUSION

The clinical pharmacist's shows a major appearance in emergency department focused to grow and develop. Other health care workers appeal more time from a pharmacist to be given to the department to provide essential services. Experienced ED pharmacists can help to relieve pressure on health care workers and provide effective patient management. However, a formal study of clinical practice and patient outcomes would be required to determine the overall impact and benefits of the ED clinical pharmacist.

The clinical pharmacists are acknowledged patient care privilege by collaborating with physicians or health systems. This allows pharmacists to perform therapy decision-making activities as an active member of patient’s health care team, to encourage rational use of drugs for patient’s safety and to improve patient care. The level of attention and disease management results to make control over risk factors associated with therapy and to decline in health care costs. Thus, Clinical Pharmacists are an asset for the health care workers and patients.
Health care workers are involved as the treatment team and responsible for proper patient’s care that can be sources of reducing medication errors. Effects of medication errors may affects costs of patient care, morbidity, and mortality rate. Most of the medication errors were detected, reported, and presented in an early phase of drug therapy by clinical pharmacists.

**Conflict of Interest:** The authors have no conflicts of interest.

**References**

34. Official reports of Iranian adverse drug reaction Monitoring Center (IADRMC), 2010.

54. Luisetto M (2016) Psychological and Behavior Skills for Ph. Care Practice in Medical Team. IJPPR 5.


59. Montazeri, Mitra, Cook, Deborah J. Impact of a clinical pharmacist in a multidisciplinary intensive care unit. Critical Care Medicine, 1994, 22(6), 1044-1048 [PMID: 8205814]