



ROLE OF CLINICAL PHARMACISTS IN MEDICATION SAFETY AND OPTIMIZATION OF PATIENT CARE: A REVIEW

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ABSTRACT

Clinical pharmacists make a huge contribution towards increasing medication safety and optimizing drug therapy in hospital environments. This study aims to evaluate the role played by clinical pharmacists at medication safety, reduction of medication errors and adverse drug reactions (ADRs), enhancement of medication therapy management, and collaborative efforts in interdisciplinary healthcare teams. The significance of clinical pharmacists in developing patient-centred care has been established by analysis of various interventions and case studies in hospitals. Findings suggest that even membership alone leads to substantial reductions in medication error, thereby improving patient adherence and boosting delivery of health care. Detailed statistical and case analyses in different hospitals make a point about integrating clinical pharmacists into patient care teams. Clinical Pharmacy as a field is growing to immense heights as the healthcare on the global level requires new advancements in terms of technology, knowledge, methodologies and quality patient care. The role of clinical pharmacist is a broader aspect which by the means of this study is depicted to understand their responsibilities, duties and dynamic aspects of the profession to enhance patient care and provide safe and effective medication use in hospitals.

Keywords: Clinical pharmacists, medication safety, medication errors, adverse drug reactions, medication therapy management, interdisciplinary health care.

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INTRODUCTION

Clinical pharmacists are healthcare providers who try to deliver personalized patient care focusing on optimizing medication for better health outcomes. They demonstrate their advanced education and training in pharmacotherapy through collaboration with physicians, nurses, and other health professionals to ensure drug therapies that are safe, effective, and cost-efficient. Therapeutic application of drugs defines the clinical pharmacist. They assess all aspects of the drug therapies performed by a patient in terms of cost and safety. Also, efficacy and appropriateness are considered to be assistive in the prevention of adverse drug reactions and medication errors. Clinical pharmacists traditionally manage medication therapy, hence expected to improve disease conditions, treatment adherence, and patient health. They serve as key links between patients and physicians regarding drug use, thereby promoting clearer communication and understanding and improving patient outcomes in education and adherence. Cost-saving lifestyles concerning healthcare are achieved through cost-effective therapy and prevention of complication due to medicines.

Clinical pharmacists perform a variety of roles in hospitals, including participating in ward rounds and counselling patients on the various aspects of health. Reviewing medication histories and making therapeutic recommendations to the doctors, selecting, calculating, and sustaining the correct drugs, keeping a lookout for drug-drug interactions, adverse effects and contraindications; modifying treatment as necessary. Taking a major role in informing patients about their medications, how to use it, possible side effects, appropriate lifestyle changes to adhere to safety requirements. One of the typical functions in this hospital is the actual functioning of clinical pharmacists: they manage complex drug regimens, order blood tests, and may write prescriptions under formal agreements with doctors but ensure appropriate patient preparation, storage, and administration of drugs, reconcile medications, and provide notices for patients who have particular needs or use high-risk medications, give medication information to health institutions, develop therapeutic recommendations, and conduct clinical research.

To optimize medication for better health outcomes, clinical pharmacists are health care professionals who strive to achieve individualized patient care. Their advanced education and training in pharmacotherapy enable collaborative efforts with physicians, nurses, and colleagues in health care to ensure safe, effective, and cost-efficient drug therapies.

Background and Significance of Clinical Pharmacy

It is quite clear that the emergence of clinical pharmacy in any hospital has been with the special concern towards the improvement of the medication use and patient safety. The growing

complexity of drug therapy and the increased need for medication safety measures have been highlighted by the WHO and other health agencies around the world, and it has become even more imperative for clinical pharmacists now-a-days with their evolving role from dispensing-exclusivity to active participation in patient care. They have therefore defined that clinical pharmacy is a major player in these safety initiatives.

A research study conducted by the American Society of Health-System Pharmacists (ASHP) found that hospitals without clinical pharmacists registered more than a 40% incidence of medication errors. Further, pharmacists serve a critical role in patient counselling, which helps healthcare outcomes by enhancing adherence rates.

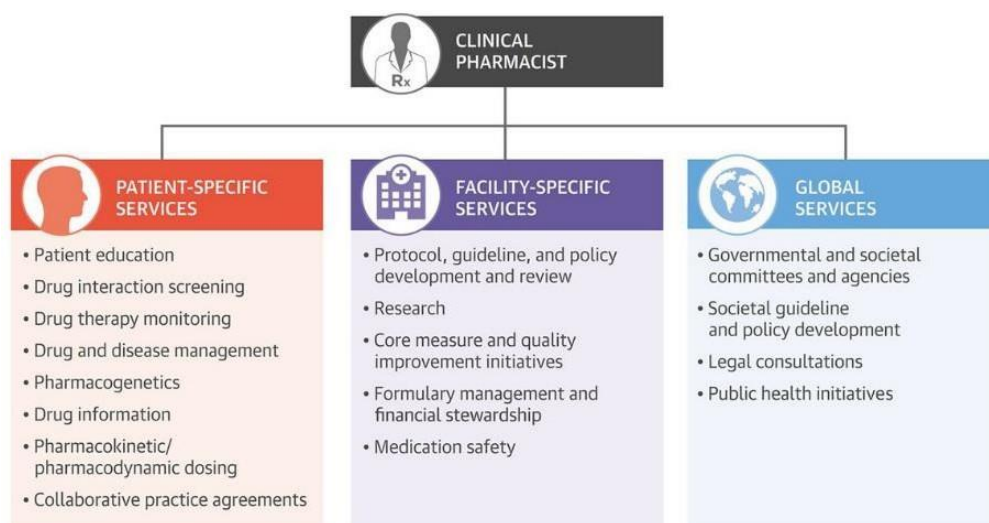


Figure 1. Clinical Pharmacist's Extensive Services

Historical Evolution of Clinical Pharmacy

In the mid-20th century, clinical pharmacy first appeared as a field of specialization as the role of the pharmacist transformed from dispensing medications to incorporating a component of dialogue with patient care. The momentous change began in the mid1960s from the United States of America, which allowed pharmacists to directly provide medication therapy recommendations. They began rendering special therapeutic services by this time mainly as a consequence of complexity in chronic diseases and drug therapies, as well as the necessity for minimizing adverse events connected with medication or drug therapy.

By the 1970s and 1980s, clinical pharmacy programs became permanently integrated into the healthcare systems of North America and Europe, paving the way for pharmacist-led interventions in hospitals. In 1990s, international health organizations such as the World Health Organization (WHO) and the International Pharmaceutical Federation (FIP) began to identify clinical pharmacists as indispensable health providers, and thus, worldwide clinical pharmacy services were introduced in hospitals on a global scale.

Historical Evolution of Clinical Pharmacy in India

Over the last few decades, clinical pharmacy in India has undergone tremendous change due to regulatory improvements, curriculum changes, and an increased emphasis on patient-centric care.

There was an establishment of the concept of clinical pharmacy which actively focused upon the role of the pharmacist in maximizing the benefits of pharmaceutical therapy towards improved quality of life. For instance, with Hepler and Strand introducing 'pharmaceutical care' in 1990 to mean that the pharmacist was a member of the medical team responsible for the patient-oriented management of drug therapy of patients-this concept was getting its ground in India. This was the time when the Pharmacy Council of India (PCI) and All India Council for Technical Education (AICTE) began to revise pharmacy education to give place to clinical pharmacy, conditionally accepting the preparation of future pharmacists for clinical roles.

In 1984, the first postgraduate course in Hospital and Clinical Pharmacy came to be effectively initiated at the Delhi College of Pharmacy with Dr. B.D. Miglani, the father of Indian hospital pharmacy. This was the first big step toward formal clinical pharmacy education in India.

From the mid-1990s, some institutes such as the Christian Medical College (CMC), Vellore (1996), and the J.S.S. Hospital & College of Pharmacy, Mysore (1997) initiated postgraduate programs in clinical pharmacy and pharmacy practice. The founding of these programs has been enhanced through international collaborations, such as one Indo-Australian project that facilitated clinical pharmacy training exchanges.

The first attempt to put in place a Pharma.D program in India was at Government Medical College, Trivandrum, in 1999, the aim being to produce pharmacists able to undertake direct patient care and manage complex pharmacotherapy.

This newly started Doctor of Pharmacy (Pharm.D) program by the Pharmacy Council of India (PCI) in early 2008 has literally revolutionized the clinical pharmacy practice in India. Till now, pharmacists in India were largely confined into boundaries that included manufacturing, dispensing, and little or no patient interaction ignoring any kind of direct patient-related care or therapeutic decision-making in such cases. The six years Pharm.D program specifically designed to fill the gap was meant to arm pharmacists with advanced clinical knowledge, medication therapy management skills, and the ability to function as integral members of an interdisciplinary healthcare team.

The Pharm.D program curriculum is quite comprehensive and patient-centered, dealing with topics like clinical pharmacy, pharmacotherapeutics, clinical pharmacokinetics, hospital and community pharmacy, clinical research, pharmaco-economics, and a compulsory one-year

internship in a hospital setting. This ensured that graduates are industrially equipped not only in appropriate science regarding medicines but also in the art of patient care such as interviewing regarding medication history, monitoring of adverse drug reactions, patient counselling, and therapeutic drug monitoring. The implementation of this Pharm.D program resulted in establishing and expanding clinical pharmacy services in teaching hospitals throughout the country. Fourth and final-year Pharm.D students and graduates began actively contributing to hospital clinical pharmacy services.

The increased recognition given to clinical pharmacists in enhancing patient outcomes by hospitals of India is of prime importance. Their involvement in medical teams has significantly enhanced medication safety, diminished adverse drug reactions, and improved treatment outcomes for patients, particularly in critical care areas. Pharmacovigilance programs and adverse drug reaction monitoring centers have been spread across the country, allowing the clinical pharmacist to help identify, report, and analyses adverse drug reactions. All of these play an important role in promoting patient safety and rational medication use.

Antimicrobial stewardship programs (AMSPs) work closely with clinical pharmacy interventions. Clinical pharmacists review antibiotic orders, assess therapeutic outcomes, and provide ongoing education to other health care providers regarding rational drug use. Such interventions optimize antibiotic therapy, minimize selection pressure for antimicrobial resistance, and encourage rational use of drugs. All these changes represent a giant leap forward for pharmacy practice and place clinical pharmacists among the key stakeholders in quality health care and patient-centered medication management in India.

The COVID-19 pandemic showed the paramount importance of clinical pharmacists in drug therapy management of very ill patients. Since then, their expertise in medication selection, drug dosing, monitoring for drug interactions, and adverse effect prevention has become paramount in therapy optimization and patient safety during an unprecedented healthcare challenge. Clinical pharmacists became instrumental in antimicrobial stewardship, medication reconciliation, and providing communication and medication use recommendations to physicians through evidence-based means in the COVID-19 care settings.

With these benefits affirmed, government policies and healthcare institutions are now backing these initiatives with strong emphasis, which correlate pharmacy services to medication safety, chronic disease management, and tele pharmacy. Tele pharmacy and remote medication management clinics have empowered pharmacists to extend their services to provide continuity of care and better clinical outcomes for chronic disease patients, even during lockdowns and healthcare disruptions. As a result of this trend toward recognition and expanding scope of

practice in patient entered healthcare and pharmaceutical practice in India, clinical pharmacists' demand is on the rise in private hospitals, research institutions, and pharmaceutical companies; therefore, the trend is expected to consolidate and further catalyze the changing healthcare environment's role of the clinical pharmacist.

Global Trends in Clinical Pharmacy

It is the role of clinical pharmacy services internationally, driven by health requirements, regulatory encouragement, and advances made in pharmaceutical sciences, to develop. Integration of the pharmacist into teams is a trend observed throughout other continents in the world, with countries both developed and developing making notable strides.

Clinical pharmacy has been introduced in health organizations all over the world; making a dent in how patients are treated and how they take care of patients. Clinical pharmacists help ensure that medications are used safely and effectively-something which has led fewer medication errors and better overall outcomes for patients. They help in customizing treatments with doctors and other healthcare professionals, especially for patients suffering from mostly chronic and complicated health conditions. Clinical pharmacists are key players in preventing adverse health outcomes as they assist patients in the proper use of medication and adherence to the treatment regimen. Some of their contributions also include promoting proper antibiotic use and support for immunization programs as public health initiatives. Last but not least, clinical pharmacy now provides the highest quality health services with cost-effective, efficient care across the globe.

North America (United States & Canada)

Clinical pharmacists are important members of interdisciplinary healthcare teams. In-depth integration of MTM programs for optimal drug use will prevent adverse medication reactions. Pharmacist-led clinics for chronic disease management (e.g., diabetes, hypertension) are numerous. Heavy orientation to pharmacovigilance and real-time EHRs for medication monitoring.

Europe (the United Kingdom and the European Union)

Clinical Pharmacy is quite strong in the hospitals, and ward-based pharmacists have a very critical role to play. The European Association of Hospital Pharmacists (EAHP) empowers clinical pharmacy practice enormously. Many countries, including the UK and Sweden, have pharmacist-prescribers. Antibiotic consumption is targeted in AMSPs through combating antibiotic resistance.

Australia & New Zealand

Pharmacists occupy a central position in medication safety programs and the prevention of

adverse drug events (ADEs). Pharmacies may often get involved in tele pharmacy and remote patient monitoring for patients with limited access, especially in rural settings. Clinical trials and research are very much in view, with the pharmacist having a role in drug development studies.

Asia & Middle East

Countries where there has been a rapid expansion of hospital-based clinical pharmacy services include China, India, Japan and Saudi Arabia. Government initiatives for pharmacist-led medication safety programs in this region are booming. Increased attention is being given to pharmacogenomics and personalized medicine. Integration of clinical pharmacists into teams in oncology, cardiology, and infectious diseases has positively impacted healthcare.

Africa & Latin America

Improved visibility of clinical pharmacists in public health projects. Pharmacists actively engage in vaccination programs and response to epidemics (e.g., COVID-19, malaria, and HIV/AIDS). Resource constraints limit clinical pharmacy services in some regions. New trends in community-based clinical pharmacy intervention have been seen in Africa and Latin America.

Assessing the Role of Clinical Pharmacists in Promoting Medication Safety in Hospitals Medication Reconciliation and Error Prevention

Clinical pharmacists are responsible for conducting medication reconciliation at various points, including hospital admission, transfer, and discharge, in order to help prevent discrepancies in patient prescriptions. Evidence suggests that pharmacist-led medication reconciliation programs reduce medication discrepancies between 60% and 80%. Pharmacists intervene in cases of potential problems such as under- and overdosing, duplicated drugs, and drug interactions that could be harmful to the patient.

Monitoring and Managing Adverse Drug Reactions (ADRs)

A pharmacist active both in the identification and documentation of ADRs, and in their mitigation, plays this role in pharmacovigilance. Proactive clinical pharmacy-based hospital studies have demonstrated reductions of incidence of ADRs attributable to clinical pharmacists by as much as half. Reporting of cases of ADR to national and international databases for drug safety enhances the bigger picture for medication safety.

Role in Antimicrobial Stewardship Programs (AMSP)

As a part of their patient care services, the clinical pharmacist interface with the experts in the field of infectious diseases to improve the antibiotic therapy received by patients and to mitigate development of antimicrobial resistance. The AMSP programs have brought about a 30-50%

reduction in inappropriate antibiotic prescribing within the in-hospital environment. Interventions undertaken by the clinical pharmacist invariably give rise to an improvement in patient recovery and shorter duration of hospital stays.

Ensuring Safe Medication Administration

Evaluation comes in for nurses and other health profession practitioners; Nurses and other health profession regulators have different guidelines regarding the proper administration of complex medication therapies. Some highlight blaring issues with medication safety, for instance, using barcode scanning, double-checking high-risk medications, and calculations of doses. Research has indeed shown that pharmacist-led training on medication administration decreases administration errors by as much as 40%.

Patient Counselling and Education

The patients have individual counselling by pharmacists on medication adherence, side effects, and drug usage. Patient education reduces self-medication errors and adverse reactions. Meta-analysis has reported that patient education by pharmacists improved the rate of adherence to medications by 30-50%.

Integration into Interdisciplinary Healthcare Teams

Clinical pharmacists work in close collaboration with physicians, nurses, and other providers in an effort to provide complete patient care. Interprofessional collaboration leads to improved clinical outcomes as well as a reduction in medication errors and enhancement of patient safety. One study showed that in hospitals in which strong pharmacist-physician collaboration was achieved, there was a 25% reduction in medication-related complications.

Implementation of Technology for Medication Safety

This would be new advocacy sites created for all pharmacists in prescribing with electronic prescription, computerized physician order entry (CPOE), and clinical decision support systems (CDSS). Implementation of these has changed the patterns of prescribing errors in hospitals to no less than 50-70%.

Pharmacoeconomics and Cost-Effectiveness of Medication Safety Programs

The way pharmacists actually help in cost containment is through the selection of cost-effective, yet clinically optimum therapies. Research has suggested that pharmacist-initiated initiatives in medication safety yield hospitals millions in cost reductions due to preventable medication errors.

Pharmacists participate in cost containment through the selection of appropriate value therapies while ensuring that the clinical outcome is optimal. Research indicates that pharmacist-initiated initiatives in medication safety reduce costs by millions in hospitals from preventable

medication errors.

Determining the Effects that Clinical Pharmacists Have in Minimizing Medication Errors and Adverse Drug Reactions (ADRs) in Hospital Patients

Reduction of Medication Errors

Medication errors such as prescribing, dispensing, and administering are causes for serious risk among hospitalized patients. Clinical pharmacists are proactive in identifying and preventing medication error through prescription review, patient monitoring, and dosage adjustments. In general, the presence of clinical pharmacists in a hospital ward reduces the occurrence of medication errors by 50%. Pharmacist interventions lead to improved medication adherence and decreased drug-related hospital readmissions.

Preventing Adverse Drug Reactions (ADRs)

Adverse drug reactions are a major cause of prolonged hospital stays and increased costs in health care. Clinical pharmacists monitor the patients for potential ADRs, offer alternatives, and educate the healthcare teams on high-risk medications. According to research data, pharmacist-led ADR monitoring programs prevent ADRs by as much as 40%. Clinical pharmacists, by documenting and reporting ADRs to pharmacovigilance programs, are a partner in the global initiative for drug safety.

Pharmacist-Led Interventions in High-Risk Patient Populations

High-risk patients include the elderly or patients with chronic diseases, making them more prone to medication errors and ADRs. They can perform medication therapy reviews and collaborate with physicians in making the best treatment plan for these patients with a higher risk. Reports from studies in hospitals have found that pharmacist led medication therapy reviews resulted in a 30 percent reduction of preventable ADRs among high-risk patients.

Implementation of Computerized Decision Support Systems (CDSS)

The clinical pharmacist has endeavored to install computerized decision support systems to reduce prescribing errors. The CDSS alerts health care providers to the potential for drug interactions, contraindications, and duplicate therapies. Medication errors were reported to have been reduced by 60% in hospitals that employed CDSS with pharmacist supervision.

Real-World Case Studies Demonstrating Impact

A study in a tertiary hospital demonstrated that pharmacist interventions averted 200 errors in medication over a year. In a randomized controlled trial, hospitals with clinical pharmacy services had 35% less ADR-related hospitalization incidents than hospitals without pharmacists. Implementation of a pharmacist-led Medication Safety Programmed within an intense care unit (ICU) led to a 45% decline in medication-related complications.

Contribution of Clinical Pharmacists in Optimizing Medication Therapy Management (MTM) for Inpatients

Comprehensive Medication Review and Optimization

Clinical pharmacists undertake extensive reviews of medication therapy to evaluate efficacy and safety of drugs. They recommend alternative therapies for a patient if contraindications or inefficacies so dictate.

Personalized Medication Regimens

Pharmacists individualize drug regimens on the basis of the patient's age, kidney function, and any comorbidities. They further tweak the dosages and timings for the drug to achieve maximum therapeutic effect with minimum side effects.

Patient Counselling and Adherence Monitoring

Provide information to patients on medication use, side effects, and adherence strategies. Studies show that pharmacist-initiated counselling enhances adherence to medications by 20 - 30%.

Collaboration with Physicians and Nursing Staff

Clinical pharmacists partner with physicians, and nurses to ensure the correct selection of drug therapy. Their contributions help modify treatment plans, limit drug interactions, and enhance patient outcomes.

Monitoring and Managing Polypharmacy

It identifies instances of polypharmacy, particularly in older persons and in chronically ill patients, intended to reduce the burden of drugs. Deprescribing initiatives with pharmacists have shown additional patient safety efforts and decreased adverse drug events.

Investigating the Involvement of Clinical Pharmacists in Interdisciplinary Healthcare Teams for Improving Patient Outcomes

Collaboration of Physicians with nurses

Clinical Pharmacists work with the physicians and nursing staff to reach evidence-based therapeutic plans. Input about drug interactions, contraindications, and therapeutic alternatives is invaluable.

Role in Multidisciplinary Rounds

Attending daily rounds enhances communication among all disciplines, and studies have shown that pharmacists' contributions during these rounds have been effective in reducing hospital-acquired complications and facilitating sound clinical decisions.

Enhancing Care for Chronic Disease Patients

Clinical pharmacists develop chronic disease therapy strategies in the areas of diabetes,

hypertension, and COPD in conjunction with optimizing the medication regimen. They also counsel patients to help promote adherence to long-term therapies.

Pharmacist-Led Medication Management Programs

Medication management programs afford patient-centered views on medication inputs and prevent unnecessary medication use. Pharmacists uphold that medication plans are conformed to best practices and clinical guidelines.

Improving Patient Outcomes through Interprofessional Education

Conducting training sessions for healthcare providers on medication safety and emerging drug therapies. This encouragement is meant to promote and uphold an interdisciplinary approach to patient-centered care with the ultimate goals of improving treatment success and reducing healthcare costs.

Economic and Clinical Benefits of Clinical Pharmacy

Clinical pharmacists not only enhance patient outcomes but also serve to cut costs for healthcare systems. Research shows that interventions by a pharmacist lead to a 40% reduction in medication errors in hospitals with active pharmacy services and a 30% decrease in hospital readmissions due to optimized medication therapy. Ultimately, significant cost savings arise from diminished adverse drug reactions and less unnecessary hospital stay time.

Economic Impact of Clinical Pharmacy

Reduction in Hospital Readmissions and Length of Stay-Clinical pharmacists play a critical role in optimizing medication therapy to prevent adverse events and readmission to hospitals. According to evidence, their interventions, such as medication reconciliations and optimizations, reduced hospital readmission rates by 30-40 percent. Good medication therapy management leads to clinical outcomes improvement and cost saving for the health care systems. The pharmacists would approve the most appropriate medications and monitor for complications, thus resulting in better recovery of patients, lessening overall hospital stay durations by 10-25 percent. Thus, better resource utilization for hospitals and less operational costs.

Prevention of Medication Errors and Associated Costs

Medication mistakes account for a majority of avoidable healthcare expenses because they lengthen hospital stays and require additional treatment. Clinical pharmacists remain an integral part of medication error prevention through careful medication reconciliation and scrutiny of prescriptions. Between about 60 and 70 percent of medication errors, can be prevented through their involvement, which also saves substantial financial shore to hospitals in managing complications arising from medication errors. By correcting problems such as incorrect

dosages, drug interactions, and administration mistakes before they reach the patient, pharmacists improve both safety and cost-effectiveness in healthcare delivery.

Cost Savings from Pharmacovigilance and ADR Management

ADRs, having dire consequences on hospital admissions and prolonged hospital stay, raise the hospital expenditure. Clinical pharmacists uphold vigorous pharmacovigilance programs and monitor ADRs, thus managing them to a lower incidence rate of about 40 to 50%. Their preventive approach increases patient safety, saves the healthcare system from incurring costs associated with additional interventions, and prevents the burden of drug-related complications. Effective management of ADRs ensures that less of the resources of the health care system are used for recovery rather than for managing avoidable harm.

Economic Benefits in Chronic Disease Management

These MTM programs lead to changes in economic circumstances brought about by chronic illnesses such as diabetes or hypertension or any form of cardiovascular complications. Pharmacists can help limit the complications and need for hospitalization through adherence improvement in treatment regimens and patient education. Pharmacist interventions in care for diabetes are associated with overall patient treatment costs reduced by an estimated 20%-30% due to decreased incidences of extreme complications or patient hospital care. Proactive management would mean healthier patients and more sustainable healthcare financing.

CONCLUSION

This study clearly shows that clinical pharmacists increasingly hold a vital and recognized role within the hospital environment. Their role goes way beyond dispensing drugs; rather, they care for patients to ensure that each one receives the most appropriate and safe treatment. They assess medication orders and help identify drug interactions as well as providing advice with influence based on the condition and medical history of each patient. Their most invaluable point of work is collaborating with other healthcare professionals. Being part of a multidisciplinary team along with doctors, nurses, and specialists enhances holistic treatment approaches. They work during ward rounds and case discussions to give a better- informed decision-making process that would sometimes lead to a better outcome and a reduction in preventable medication errors. Clinical pharmacists also educate patients and health personnel. They may counsel a patient on their proper intake of medications or inform the medical staff about new drug therapies; their knowledge is a necessity to high standards of care. The extended role also marks in the duties and responsibilities of clinical pharmacists in maintaining inventory control, proper stock in accordance to expiry dates, filing and maintenance of sales and purchase record, records of drugs under special category such as Narcotics, compliance of regulatory guidelines in the

hospital pharmacy and many more supervising duties under his/her control. The extensive role of clinical pharmacists extends not only to out patients but rather has a great impact on the treatment of the in-patients that is those who have been admitted to the hospital due to some condition. The role has magnificent and humungous aspects for which the quality of healthcare in a hospital setting revolves around. The medication reconciliation, proof reading of prescription order and surveillance of treatment to the patient brings in the sincere duties of clinical pharmacists towards in-patients. In these times of growing complexities regarding medical treatments, the roles of clinical pharmacists are exceedingly important now than before. Their expertise further bridges the gap between pharmaceutical science and clinical practice leading to better patient outcomes through an efficient healthcare system. The findings from this project clearly indicate that having clinical pharmacists on the team with physicians toward improving patient care can make such personalized, safe, and high-quality care that it is no longer adjunctive. Rather, such integration becomes imperative in any hospital setting. Overall, this study has clearly signified the presence, the duties, the responsibilities of clinical pharmacists in the hospital settings and helped understand the noteworthy impact on the outcome of splendid success of patient treatment and welfare in the hospital environment.

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