Volume 11, Issue 5, May – 2026 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

Clinical Pharmacy and its Impact on Healthcare System

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Publication Date: 2026/05/22

Abstract: Clinical pharmacy has become a crucial part of modern healthcare by improving the safe, effective, and rational use of medicines and enhancing overall patient outcomes. This review outlines its introduction, historical development, and present status in India, where its role is steadily expanding. It also emphasizes the important contributions of clinical pharmacists in promoting rational drug use, identifying and managing adverse drug reactions, and supporting evidence-based medical practice. Working in collaboration with healthcare teams, clinical pharmacists help optimize drug therapy and ensure patient safety. The article further discusses future scope and emerging opportunities in this field, especially in patient-centered care and the improvement of healthcare systems.

Keywords: *Clinical Pharmacy, Rational Drug Use, Adverse Drug Reactions, Evidence-Based Medicine, Clinical Pharmacist, Healthcare System, Patient Care.*

How to Cite: Jasmine Dhiman; Samiksha Sharma; Sanjiv Duggal (2026) Clinical Pharmacy and its Impact on Healthcare System. *International Journal of Innovative Science and Research Technology*, 11(5), 1069-1079. https://doi.org/10.38124/ijisrt/26may171

I. INTRODUCTION

Clinical pharmacy is an important branch of pharmacy practice that focuses on the rational use of medicines, along with promoting patient health, disease prevention, and overall well-being. It has gained global recognition as a crucial part of interdisciplinary healthcare systems.[1] In India, a country with a population exceeding 1.4 billion and significant urban–rural disparities in healthcare access, the role of clinical pharmacists is especially important. Over time, pharmacy practice in India has shifted from a product-oriented approach focused on dispensing medicines to a more patient-centered model. Modern clinical pharmacy services now include medication therapy management, patient counselling and education, as well as monitoring and reporting of adverse drug reactions (ADRs).[2]Despite these advancements, clinical pharmacy in India is still developing and is influenced by educational reforms, regulatory frameworks, and socioeconomic factors. A major milestone in this evolution was the introduction of the Doctor of Pharmacy (PharmD) program by the Pharmacy Council of India (PCI) in 2008. This program was designed to develop clinically skilled pharmacists capable of participating in direct patient care alongside physicians and other healthcare professionals.[3]Before this, pharmacy education in India mainly emphasized pharmaceutical manufacturing and distribution, with limited focus on clinical roles.[4] Currently, India faces a rising burden of non-communicable diseases (NCDs), increasing antimicrobial resistance, and a high rate of medication errors, estimated at around 5.2 million cases annually. In this context, clinical pharmacists play a vital role in optimizing therapeutic outcomes, improving medication safety, and reducing drug-related problems within the healthcare system.[5]Clinical pharmacy services in secondary care settings began developing in the 1970s and have since evolved into what is now known as pharmaceutical care. However, their growth in primary care has been comparatively slower. One key reason is the existing remuneration system, which still prioritizes the speed and accuracy of dispensing prescriptions over patient-centered services. To improve the quality, efficiency, and accessibility of pharmaceutical care in primary care, it is necessary to reassess and restructure the dual role of pharmacists as both healthcare providers and business operators. Research suggests that approximately 11.4% of hospital admissions are linked to issues related to drug therapy, and addressing these at the dispensing stage could significantly reduce healthcare costs.[6-8] Additionally, a review of adverse drug reaction (ADR) data from multiple hospitals indicates that ADRs account for 0.2% to 21.7% of hospital admissions[9]. Among these, the majority are due to side effects, followed by excessive pharmacological effects, hypersensitivity reactions, and a small proportion of idiosyncratic responses. Earlier studies have also highlighted concerns related to prescribing practices. For instance, Neville et al. reported that 1.06% of prescriptions contained therapeutic errors, possibly due to inadequate control of computerized repeat prescribing systems.[10-11]Further analysis of prescribing patterns in

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

general practice revealed that a significant proportion of repeat prescriptions had not been reviewed by a physician for extended periods. Harris reported that nearly 75% of prescribed items were repeat prescriptions, accounting for a major share of prescribing costs, with a considerable number of patients obtaining medications through this system.[12]This indicates that many prescriptions are generated through patient-initiated repeat requests. These findings highlight the need for greater involvement of clinical pharmacists at both prescribing and dispensing stages. Therefore, this paper focuses on the available evidence regarding pharmaceutical care practices in the primary healthcare sector, particularly in relation to the dispensing process.[13-14]

➢ *Historical Evolution of Clinical Pharmacy in India*

- *Early Development of Pharmacy in India:*

The roots of pharmacy in India can be traced back to traditional systems like Ayurveda and Unani. However, modern clinical pharmacy began to develop after independence. A major step was taken in 1948 with the establishment of the Pharmacy Council of India (PCI) under the Pharmacy Act. This helped in regulating the pharmacy profession. During this period, the concept of clinical pharmacy was not yet introduced[15].

- *Early Pharmacy Education System:*

In the beginning, pharmacy education in India was limited to the Diploma in Pharmacy (DPharm). The course mainly focused on compounding and dispensing of medicines. Pharmacists had very little involvement in patient care. They were generally seen as suppliers of medicines rather than healthcare professionals. As a result, their role in the healthcare system remained limited[16].

- *Introduction of Degree Programs (BPharm):*

During the 1970s and 1980s, the Bachelor of Pharmacy (BPharm) program was introduced, marking progress in pharmacy education. However, the curriculum mainly emphasized industrial and manufacturing aspects. Clinical training and patient-oriented learning were not given much importance. Because of this, pharmacists still had a limited role in clinical settings [17].

- *Emergence of Clinical Pharmacy Practice (1990s–2008):*

The concept of clinical pharmacy started developing in India during the 1990s. In 1996, MPharm in Pharmacy Practice was introduced at institutions like JSS College of Pharmacy. This included activities such as ward rounds and drug information services. A major breakthrough came in 2008 with the introduction of the PharmD program, which focused on clinical training and hospital exposure[18-19].

- *Current Growth and Challenges:*

At present, clinical pharmacy in India is growing steadily. By 2024, more than 200 institutions are offering the PharmD program, producing many graduates every year. However, development is not uniform across the country, with southern states leading. Despite efforts by the government and organizations, challenges such as lack of awareness, limited infrastructure, and incomplete implementation still exist[20-23].

➢ *Current Status of Clinical Pharmacy in India*

- *Expanding Role of Clinical Pharmacists:*

Clinical pharmacy in India is gradually progressing, but it is still not fully utilized. Since the introduction of the PharmD program, more than 10,000 graduates have been trained. Many are working in hospitals and contributing to patient care activities. Their roles include medication reconciliation, patient counselling, and ADR reporting. This shift indicates a growing focus on patient-centered pharmacy practice[24].

- *Practice in Private Healthcare Sector:*

In private hospitals like Apollo and Fortis, clinical pharmacists are actively involved in healthcare teams. They participate in ward rounds, antimicrobial stewardship, and pharmacovigilance activities. Their role helps in reducing drug-related problems and improving therapy outcomes. Studies show that around 1.5 DRPs per patient are identified. Most of their interventions are accepted by doctors, showing their importance[25-26].

- *Education and Training System:*

Pharmacy education in India has improved with the introduction of clinical programs like PharmD. PCI-approved institutions must be linked with 300-bed hospitals for training. However, many private colleges lack proper facilities for clinical exposure. This creates a gap between theoretical knowledge and practical skills. As a result, not all graduates are equally prepared for clinical roles[27].

- *Community Pharmacy Scenario:*

India has more than 550,000 community pharmacies, but most operate on a commercial basis. Pharmacists mainly focus on dispensing pre-packaged medicines rather than patient care. Clinical services like counselling are limited and not consistently provided. This reduces the effectiveness of pharmacists in community healthcare. There is still significant scope to improve their role in this sector[28].

- *Government Sector Limitations:*

In government hospitals, pharmacists mainly handle procurement and distribution of medicines. Their involvement in clinical and patient care activities is very limited. This restricts the growth of clinical pharmacy services in the public sector. Lack of awareness and clear policies further reduces their role. Strengthening this area can improve overall healthcare delivery in India[29].

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II. ROLE OF PHARMACIST IN CLINICAL PHARMACY

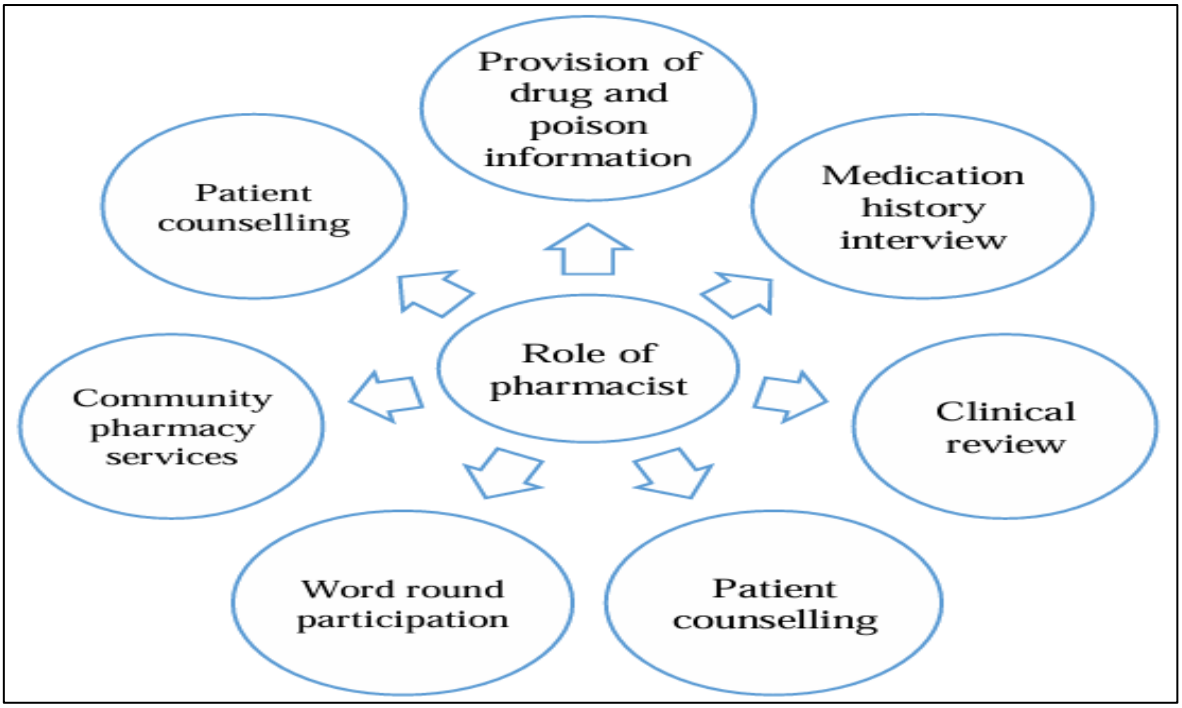

Fig 1 Role of Pharmacist in Clinical Pharmacy

➢ *Provision of Drug and Poison Information:*

- Pharmacists use electronic databases to provide updated drug and poison information.
- Tools like MICROMEDEX™, Clinical Pharmacology™, and Medscape™ are commonly used.
- Helps in checking drug interactions and ensuring safe use of medicines.
- These tools can improve healthcare services in India[30-31].

➢ *Medication History Interview:*

- Pharmacists collect complete medication history of patients.
- Helps in identifying allergies, ADRs, and drug misuse.
- Used to check patient compliance with treatment.
- Supports planning of safe and effective therapy[32].

➢ *Clinical Review:*

- Pharmacists review drug therapy for correct dose and duration.
- Correlate symptoms, lab results, and diagnosis with treatment.
- Helps in reducing medication errors.
- Important role in improving patient safety[33].

➢ *Patient Counselling:*

- Pharmacists educate patients about medicines and their use.
- Provide guidance on lifestyle, diet, and treatment.
- Teach use of devices like inhalers and insulin pens.
- Improves adherence and treatment outcomes.

➢ *Ward Round Participation:*

- Pharmacists, as part of the healthcare team, take part in ward rounds.
- Helps in understanding patient history, progress, and clinical condition.
- Provide input on drug therapy and assist in better discharge planning.
- Support selection of cost-effective medicines and improve outcomes.

➢ *Community Pharmacy Services:*

- Involve dispensing medicines, promoting healthy lifestyle, and self-care support.
- Include services like patient education, medicine review, and cessation programs.
- Participation in health promotion activities like smoking and alcohol control.
- Has great scope in India for improving public healthcare and research[33-35].

➢ *Patient Counselling:*

- Patient counselling is one of the most important roles of clinical pharmacists from the patient's perspective.
- They explain the patient's condition and guide safe and proper use of medicines to improve outcomes.
- Patients are educated about disease, treatment, diet, lifestyle changes, and use of devices like inhalers or insulin pens.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

- Pharmacists also ensure continuity of therapy, proper monitoring, and address any medication-related problems.

III. RATIONAL DRUG USE

➢ *Introduction:*

Rational drug use is an essential part of health policy. According to the WHO conference (1985, Nairobi), it means patients receive appropriate medicines, correct doses, for an adequate duration, and at the lowest cost[36].However, consumers may view rational use differently due to cultural beliefs and financial conditions. For example, some people may buy only a few antibiotic capsules due to cost or prefer painkillers instead of proper rest and nutrition.

➢ *Causes of Drug use Problems:*

Drug use problems can be classified into three levels: community, health care, and national level, each contributing differently to irrational drug use.

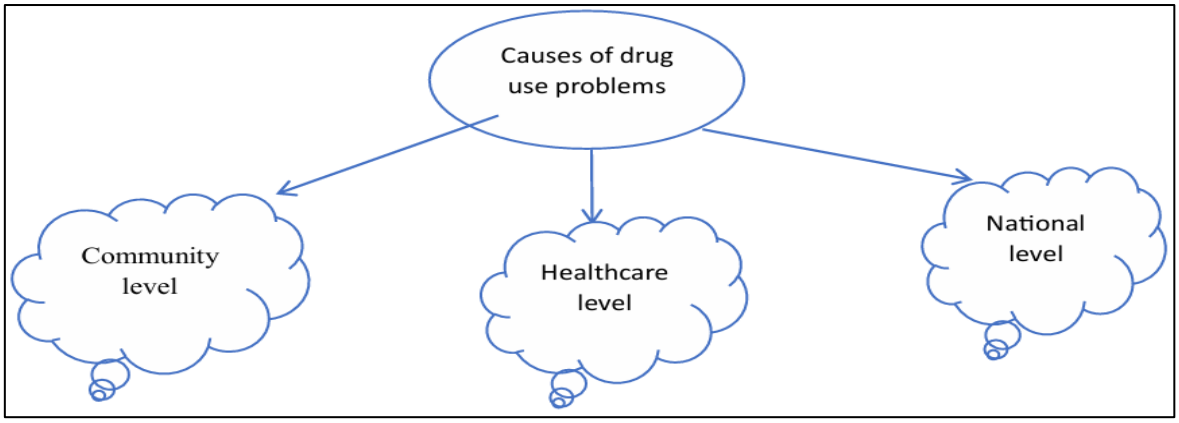

Fig 2 Causes of Drug use Problems

- *Community Level:*

At the community level, improper use of medicines is common despite correct prescriptions, mainly due to non-adherence[37-38] Patients may not follow dosage or duration properly because of poor knowledge, financial issues, or cultural beliefs. Self-medication is also highly prevalent (60–80%), often leading to misuse of drugs like antibiotics and analgesics[39-42].Additionally, personal beliefs and misconceptions about medicines influence how people choose and use drugs[43-45].

- *Health Care Level:*

At the healthcare level, irrational drug use is influenced by limited training and lack of reliable drug information among health workers. However, other factors like financial incentives and ownership of facilities can lead to overprescribing[46]. Prescribing behavior is also affected by patient demand, fear of treatment failure, and past experiences[47-48].Furthermore, misleading drug promotions and pressure from pharmaceutical companies contribute to inappropriate prescribing practices[49].

- *National Level:*

At the national level, weak or absent drug policies play a major role in irrational drug use[50]. Even when policies exist, poor implementation reduces their effectiveness. Lack of proper regulation, monitoring, and supervision leads to misuse of drugs. In addition, inadequate drug supply systems and poor storage facilities further complicate the situation, making rational drug use difficult to achieve.

➢ *Types of Public Health Consequences and Inappropriate Drug Use:*

Inappropriate drug use has several negative effects on health, although these impacts are not always fully measured. Evidence shows that misuse of medicines can lead to serious medical and economic problems.

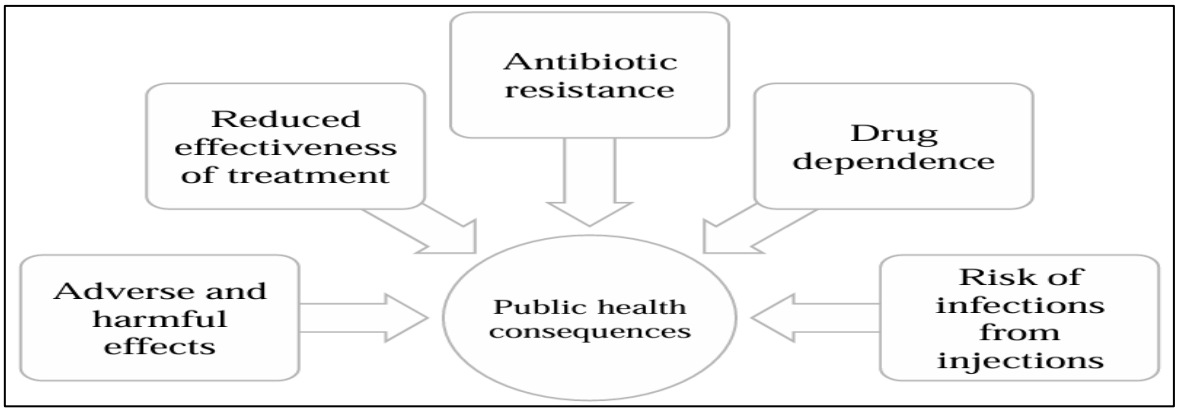

Fig 3 Public Health Consequences

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- *Adverse and Harmful Effects:*

Improper use of drugs can cause harmful and sometimes fatal outcomes. This may occur due to misuse of antibiotics or incorrect self-medication practices[51-53].Such adverse reactions can significantly affect patient safety and overall health.

- *Reduced Effectiveness of Treatment:*

When drugs are taken in incorrect doses, especially lower than required, their effectiveness is reduced. This is commonly seen in diseases like tuberculosis and leprosy, where under-dosing leads to poor treatment outcomes.

- *Antibiotic Resistance:*

Excessive and improper use of antibiotics, including taking them in inadequate doses, contributes to the development of antibiotic resistance[54-55].This makes infections harder to treat and reduces the effectiveness of existing medicines[56].

- *Drug Dependence:*

Continuous and inappropriate use of certain medicines, such as painkillers and tranquilizers, can lead to drug dependence. This issue has been recognized for many years and still remains a concern today[57-58].

- *Risk of Infections from Injections:*

Unsafe use of injections increases the risk of infections. Improper injection practices can lead to conditions such as abscesses, polio, hepatitis, and AIDS[59-60].These complications pose serious public health risks.

IV. ADVERSE DRUG REACTIONS

➢ *Introduction:*

Adverse drug reactions (ADRs) refer to harmful effects caused by medicines when taken at normal doses[61].This differs from "side effects," which may sometimes be beneficial as well[62]. The study of ADRs is part of Pharmacovigilance, focusing on monitoring and preventing drug-related risks[63].Regulatory bodies now require proper tracking of ADRs and the development of cost-effective methods to identify high-risk patients[64]. ADRs can reduce quality of life, increase hospital visits, healthcare costs, and may even lead to death.

➢ *Role of Pharmacist in ADR:*

- Program Development: The pharmacist helps in developing, maintaining, and evaluating programs to reduce ADR risk through detection, reporting, and assessment.
- Investigation of ADR: Each suspected ADR is assessed for its nature, probability, and severity.
- Risk Reduction Strategies: Pharmacists develop and implement strategies to minimize ADR risks as part of ongoing monitoring programs.
- Support to Healthcare Team: They support doctors, nurses, and other healthcare professionals in identifying and managing ADRs.
- Information Sharing: Pharmacists provide information such as lists of common ADRs related to drug classes to improve awareness.
- Reporting and Awareness: Serious or unusual ADRs are reported through systems like FDA MedWatch, and previously unreported reactions are also documented.
- Education: Pharmacists educate healthcare staff to improve recognition, reporting, and prevention of ADRs[62].

➢ *Methods of Detecting an ADR:*

- *Definition:*

Methods of detecting an adverse drug reaction (ADR) refer to the systematic approaches used for the collection and analysis of patient and drug-related data to identify harmful effects associated with medicines at normal doses. These methods involve gathering information such as patient history, medication details, and laboratory reports. They help in recognizing the time of onset, severity, and nature of suspected reactions. Overall, these methods are essential for ensuring drug safety and improving patient care.[61]

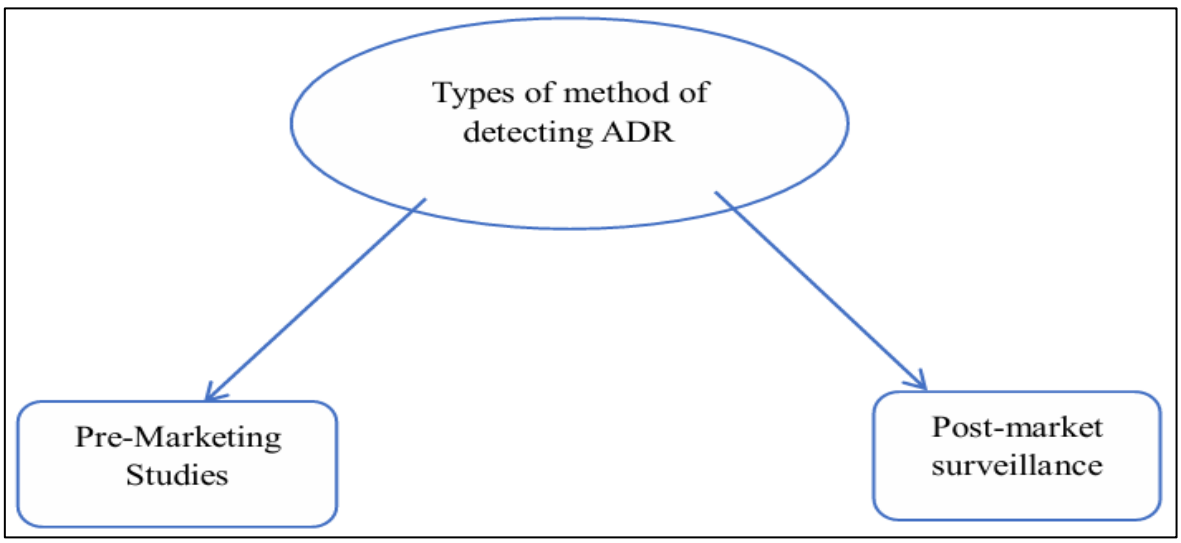

Fig 4 Types of Method of Detecting ADR

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

- *Pre-Marketing Studies:*

✓ It includes pre-clinical studies and clinical trials conducted before marketing approval.
✓ In pre-clinical studies, drugs are tested on animals to evaluate toxicity, affected organs, and dose-related effects.
✓ Further specific tests are done for carcinogenicity, teratogenicity, and mutagenicity.
✓ If results are satisfactory, clinical trials are conducted in humans in different phases to assess safety[63].

- *Post-Marketing Surveillance:*

✓ It involves monitoring drugs after they are available in the market.
✓ It helps in detecting rare, delayed, or long-term ADRs not seen in clinical trials.
✓ Methods include case reports, cohort studies, case-control studies, prescription event monitoring, and spontaneous reporting systems.
✓ Spontaneous reporting is the most sensitive and cost-effective method for detecting unknown ADRs[63].

➢ *Management of an ADR:*

- Withdrawal of Suspected Drug: The first and most important step in managing an adverse drug reaction (ADR) is to stop the suspected drug(s).
- Dose Adjustment: If the reaction is dose-related, reducing the dose of the drug should be considered instead of complete withdrawal.
- Treatment Approach: Management may involve symptomatic treatment or specific therapy depending on the type and severity of the reaction.
- Therapeutic Objective: A clear treatment goal should always be kept in mind during management.
- Duration and Review: Treatment should not be continued longer than necessary, and the patient must be regularly reviewed.
- Simplification of Therapy: Efforts should be made to simplify the overall treatment plan wherever possible[61].

V. EVIDENCE BASED MEDICINES

➢ *Introduction:*

The use of evidence-based medicine (EBM) allows findings from large clinical trials to be directly applied to patient care, which helps improve treatment outcomes. It promotes consistency in the management of individual patients, leading to better quality of life. It also supports the development of treatment guidelines based on strong clinical evidence. These guidelines help in effectively reviewing and discussing treatment approaches with physicians and assist in making cost-effective decisions in managed care organizations. Overall, it makes it easier for physicians to agree on clinical decisions based on documented evidence[65].

➢ *Evidence-Based Medicine is a New Paradigm in Treatment Strategies*

- *New Paradigm in Medical Practice:*

EBS is considered a new paradigm for medical practice that reduces reliance on intuition and unsystematic clinical experience. It also minimizes dependence on pathophysiology alone for clinical decision-making. Instead, it focuses more on evidence-based approaches.

- *Focus on Clinical Trial Evidence:*

EBM emphasizes using results from large clinical trials to guide individual patient treatment strategies. These trials provide strong scientific data for better decision-making. This helps in improving treatment outcomes.

- *Skills Required in EBM:*

EBM requires physicians to develop skills like efficient literature searching and critical evaluation of research. They must apply established rules of evidence while reviewing studies. This ensures better interpretation of medical literature.

- *Older Paradigm of Practice:*

Earlier medical practice relied on clinical experience, textbooks, and expert opinions for solving clinical problems. Physicians often depended on local specialists for guidance. This approach was more authority-based rather than evidence-based.

- *Value of Scientific Method in EBM:*

EBM stresses systematic and reproducible observations to improve clinical confidence in diagnosis and treatment. It helps in making more reliable predictions about prognosis and therapy outcomes. Relying only on intuition may sometimes lead to incorrect conclusions[66].

➢ *Levels of Evidence*

- *Meta-Analysis:*

Meta-analysis is a method in which results from similar studies are combined after systematically searching and reviewing previous research. It applies statistical techniques to analyze data from multiple studies together. This helps in producing a single overall estimate or conclusion. It provides stronger and more reliable evidence by combining findings of different studies.

- *Systematic Reviews:*

Systematic reviews are structured reviews of literature that focus on a specific research question. They identify, evaluate, and include all high-quality studies related to that topic. The findings are then carefully analyzed and summarized in a systematic way. Some systematic reviews also include meta-analysis for better data interpretation.

- *Randomized Controlled Clinical Trials (RCTs):*

Randomized controlled trials are experimental studies where participants are randomly divided into treatment and control groups. The control group may receive placebo while

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

the experimental group receives the actual treatment. Blinding is often used so that bias is reduced during the study.[4] This design gives strong evidence about treatment effectiveness.

- *Cohort Studies:*

Cohort studies are observational studies in which a group of people is followed over time. They compare exposed and unexposed groups to study disease development. These studies may be prospective or retrospective in nature. However, they are less reliable than randomized trials due to possible confounding factors.

- *Case–Control Studies:*

Case–control studies compare individuals with a disease (cases) and those without it (controls). The aim is to find past exposure differences between the two groups. They help in identifying possible risk factors for diseases. However, they do not clearly establish cause and effect.

- *Case Series/Case Reports:*

A case report describes a single patient's condition, while a case series includes multiple similar cases. These reports help in identifying early signs of new drug effects or reactions. They are useful for generating initial medical observations. But they provide limited scientific strength compared to larger studies.

- *Editorials and Expert Opinions:*

Editorials and expert opinions are based on professional knowledge and clinical experience. They are not based on structured research studies. They can provide useful guidance in clinical practice. However, they are considered weaker evidence in EBM.

- *In Vivo (Animal) Research:*

In vivo studies are conducted on animals under controlled laboratory conditions. They help in studying toxicity and biological effects of substances. These studies are useful in early research stages. However, results may not always apply directly to humans.

- *In Vitro Research:*

In vitro studies are performed on cells or biological molecules outside a living organism. They are conducted in controlled laboratory environments like culture media. These studies help in basic scientific understanding. But their clinical applicability is limited compared to human studies[67].

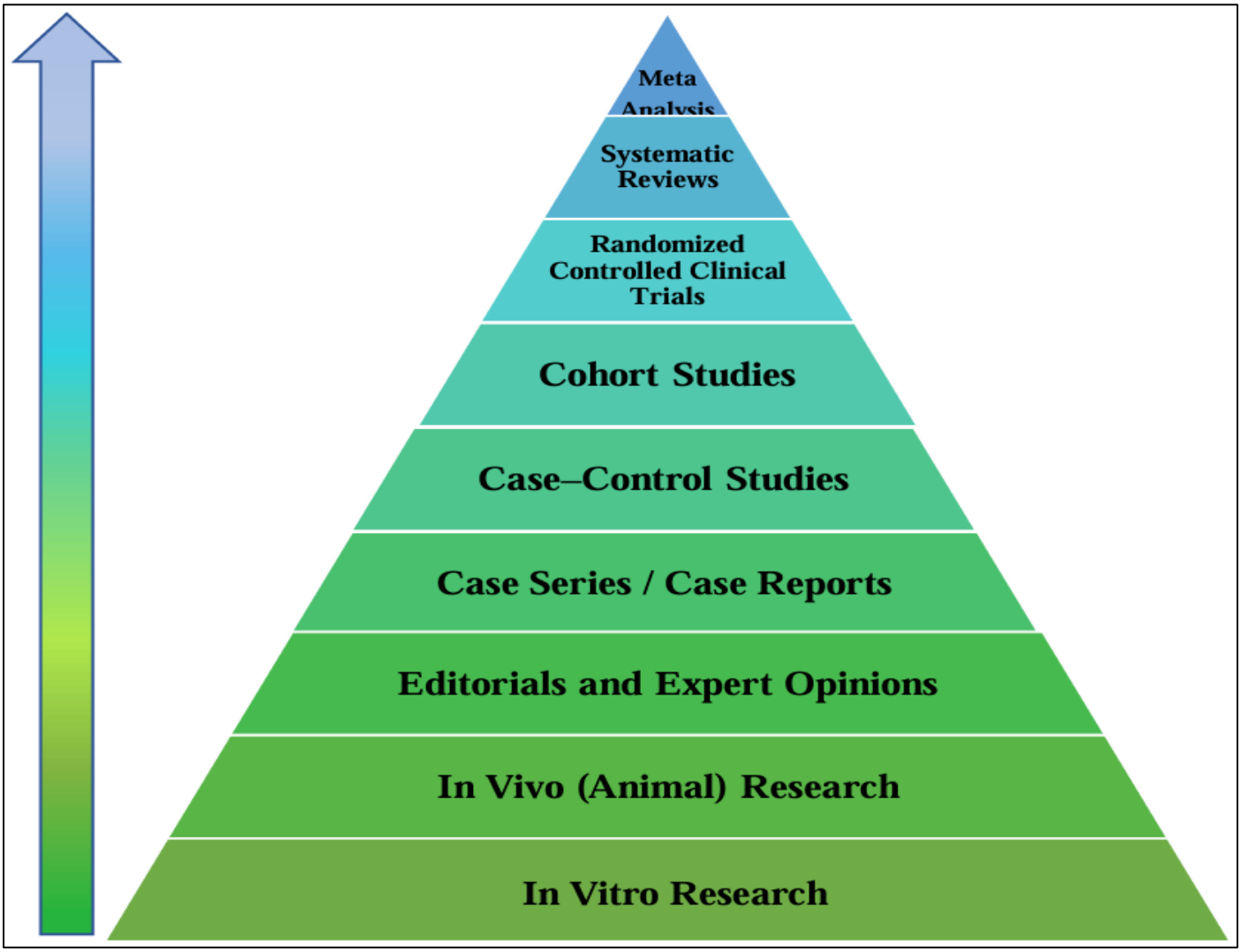

Fig 5 In Vitro Study

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

VI. FUTURE SCOPE AND OPPERTUNITIES OF CLINICAL PHARMACISTS

A Doctor of Pharmacy (PharmD) graduate is eligible to work in all areas where a Bachelor of Pharmacy (B.Pharm) qualified student can be employed. In addition, Clinical Pharmacists (CPs), including those with PharmD and M.Pharm in Pharmacy Practice, can explore several other career options after completing their course. These opportunities are based on the international scenario and, although not fully developed in India at present, are expected to become available in the near future.

➢ *Opportunities in Hospitals:*

Just as a surgeon is recognized for performing surgery and a physician for diagnosing and treating diseases, a Clinical Pharmacist is known for providing clinical pharmacy services (CPS). Delivering CPS is the primary responsibility of a CP. In India, some advanced and internationally affiliated hospitals have already started recruiting Clinical Pharmacists, and it is anticipated that government hospitals will also begin employing them in the near future. Additionally, CPs may be involved in hospital administration and can serve as members of pharmacy and therapeutics committees within hospitals.

➢ *Opportunities in Academics and Higher Education:*

Clinical Pharmacists can also build careers in the academic field by working as faculty members in pharmacy institutions. They may take up teaching roles in diploma, degree, or postgraduate pharmacy colleges as lecturers, assistant professors, associate professors, professors, heads of departments, principals, or directors, depending on their experience[68]. Currently, a large number of PharmD colleges are being established in India, creating significant job opportunities in academics for both PharmD and M.Pharm (Pharmacy Practice) graduates.

➢ *Medical Writing:*

Medical writing, also referred to as scientific writing or medical communication, involves creating various healthcare-related documents for different purposes and audiences. The type of document depends on its objective and the intended readers. Medical writers are employed in pharmaceutical and healthcare companies, CROs, BPOs/KPOs, media and publishing houses, medical journals, and professional societies. To become proficient in this field, one must have strong subject knowledge, good command of language and grammar, and the ability to quickly understand and interpret medical data[69].

- Example: Preparing a clinical study report or a patient information leaflet.

➢ *Medical Coding:*

Medical coding, also known as medical classification, is the process of converting descriptions of diseases and medical procedures into standardized and universally accepted codes. These codes are widely used in medicine, public health, and medical informatics for tasks such as data analysis and reimbursement. It helps in maintaining proper and systematic healthcare records. At present, many medical coding companies are functioning in India[70].

➢ *Medical Billing:*

Medical billing is a separate process from medical coding and involves converting healthcare services into billing claims. It plays a crucial role in the financial management of healthcare services. Although there are many health insurance companies in India, the involvement of Clinical Pharmacists in this field is currently limited. However, it is expected that opportunities for CPs may increase in the future.

- Example: Creating and submitting a hospital treatment bill to an insurance provider[71].

➢ *Pharmacovigilance:*

Pharmacovigilance focuses on ensuring drug safety by monitoring and managing adverse drug reactions. It involves the detection, evaluation, and prevention of drug-related issues. There is an increasing demand for trained professionals in this area. Important skills include a strong understanding of pharmacology, knowledge of ADRs, interpretation of laboratory data, and familiarity with clinical research.

➢ *Medical Transcription:*

Medical transcription refers to the process of converting doctors' recorded audio reports into written text. In many developed countries, healthcare professionals dictate patient details after procedures, and transcriptionists convert these recordings into accurate written documents. These records are then stored as printed files or electronic documents in patient records. Medical transcriptionists are also called medical language specialists, and modern speech recognition software is now widely used to enhance efficiency[72].

- Example: Converting a doctor's voice-recorded patient history into a typed report.

VII. CONCLUSION

Clinical pharmacy has emerged as a vital component of modern healthcare, significantly improving patient outcomes and system efficiency. From its historical evolution to its current advanced practices, clinical pharmacy focuses on patient-centered care, rational drug use, and minimizing medication-related risks. The role of pharmacists has expanded beyond dispensing to active participation in therapeutic decision-making, monitoring adverse drug reactions, and promoting evidence-based medicine. Their involvement ensures safe, effective, and economical use of medicines, thereby enhancing the quality of healthcare services. Furthermore, with increasing complexities in treatment and rising healthcare demands, clinical pharmacists play a crucial role in interdisciplinary teams. The future of clinical pharmacy holds immense potential with advancements in technology, personalized medicine, and research opportunities. Overall, clinical pharmacy continues to strengthen healthcare systems by ensuring better medication management, improving patient safety, and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may171

contributing to more efficient and sustainable healthcare delivery.

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