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"Comparative Analysis of Pharmacy Practices: India versus Developed Countries: A Review"

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Abstract

Pharmacy practice plays a pivotal role in the healthcare system by ensuring the safe and effective use of medications. This review provides a comparative analysis of pharmacy practices between India and developed countries, highlighting the differences in regulatory frameworks, education standards, scope of practice, and patient care models. In developed countries, pharmacy practice has evolved into a patient-centered, clinical service, where pharmacists actively participate in medication therapy management, patient counseling, and healthcare decision-making. In contrast, pharmacy practice in India remains more product-oriented, with pharmacists largely confined to dispensing medications and providing limited clinical services. Key factors influencing these disparities include variations in educational curriculum, regulatory policies, professional recognition, and healthcare infrastructure. The review also examines challenges faced by the Indian pharmacy sector, such as lack of standardized clinical practice guidelines, insufficient integration of pharmacists into healthcare teams, and limited opportunities for clinical pharmacy roles. Meanwhile, developed countries demonstrate a well-established clinical pharmacy model, supported by advanced technology, continuous professional development, and robust healthcare systems. This paper suggests that India's pharmacy practice can be strengthened through the adoption of global best practices, enhanced training programs, and policy reforms aimed at expanding the pharmacist's role in patient care. Bridging the gap between pharmacy practices in India and developed nations could significantly improve medication safety, patient outcomes, and the overall quality of healthcare.

Keywords: Pharmacy practice, India, developed countries, clinical pharmacy, healthcare, medication therapy management, regulatory frameworks, pharmacy education, patient-centered care.

1. Introduction

1.1 INDIA

India, a growing nation, is composed of 28 states and 7 union territories. [1]. India has a population of about 1.4 billion, making it the second most populated country in the world. [2]. The launch of a three-year bachelor of pharmacy (B Pharm) programme at Banaras Hindu University in 1937 marked the beginning of official

pharmacy education in India leading to a degree. The curriculum at the time was designed to train graduates for work as expert personnel in pharmaceutical corporations' quality control and standardisation of medications, rather than for pharmacy practice [3]. It combined pharmaceutical chemistry, analytical chemistry, and pharmacy. Before India's 1947 independence, three universities offered degree programmes in pharmacy [4]. 1944 saw the pharmacy department was founded at Punjab University, while L.M. College was founded in Ahmedabad in 1947. When India gained its independence in 1947, the British rulers left behind an unorganised pharmacy system with no legislative restrictions on the practice of pharmacy. It was not until after independence that the idea of pharmacy practice was established. To control pharmacy practice, education, and profession, the Pharmacy Act was passed in 1948 and became the first minimum quality of education required for pharmacy practice in the country [5]. To work as a chemist nowadays, one must have at least a pharmacy diploma. The Pharmacy Council of India (PCI) is responsible for putting the Act's provisions into practice. According to the Act, each state must create state pharmacy councils that are in charge of regulating and licencing chemists in their states [6]. Both colleges/schools and universities have been referred to as "institutions" throughout this text. All pharmacy schools use English as the only language of instruction.

India offers many pharmacy degree programs, including D Pharm, BPharm, M Pharm, MTech (Pharm), MS(Pharm), PharmD, and PhD. Twelve years of formal science study are required for D Pharm, BPharm, and PharmD entrance. At least two years of academic study are followed by 500 hours of obligatory practical training in a hospital or community environment in three months for the D Pharm program. The BPharm requires four years of university or college department study. With two years of study and a dissertation, BPharm graduates can earn an M Pharm in pharmaceutics, pharmacology, pharmacognosy etc. Pharmaceutical biotechnology, quality assurance, and industrial pharmacy are new M Pharm courses. JSS College of Pharmacy in Mysore and Ooty created the M Pharm program in pharmacy practice in 1996 and 1997, respectively, to prepare graduate pharmacists to provide clinical services [7]. India's six National Institutes of Pharmaceutical Education and Research provide MS and MTech degrees in pharmacy. The NIPERs were founded to provide excellent pharmacy and pharmacy education. PhDs are available to M Pharm graduates from any field after three years of education and research. Six years of full-time PharmD study are required. The three-year PharmD program takes place after graduation. The PharmD program was created in 2008 to teach pharmacists to treat patients with medications. Before the mid-1980s, government-sponsored colleges, including pharmacy schools, expanded slowly. Pharm.D. programs differ greatly from B. Pharm and M. Pharm programs.

PharmD is particularly clinically oriented, meaning it focuses on individual patients. They provide patient counselling and advise patients on how to take medications, when and how to take them, the mechanism by which drugs work in the body, potential side effects and adverse drug reactions, the main reasons why a disease manifests, and any complications that may arise if the disease is not treated. As it is shown in Table 1. They also stress the need for the patient to make lifestyle adjustments. Conversely, the M. Pharm and B. Pharm programmes are focused on the industry and discuss topics such as drug formulation, the investigation of various drug sources, the chemical structure of pharmaceuticals, the stages involved in drug synthesis, drug synthesis methodologies, drug analysis, pharmacological effects of drugs, and so forth [8].

Table 1: Top 10 Pharmacy Colleges/Universities in India that provide degree programs

YEAR OF INCEPTION	COLLEGE/ UNIVERSITY	CATEGORY	CURRENT DEGREE OFFERED
1937	Dept. of Pharmaceutical Engineering, Institute of Technology, Banaras Hindu University, Varanasi	Central University	B. Pharm, M Pharm, PhD
1944	University Inst. of Pharmaceutical Sciences, Panjab University, Chandigarh	State University	B. Pharm, M Pharm, PhD
1947	L. M. College of Pharmacy, Ahmedabad Gujrat	Private College	B. Pharm, M Pharm, PhD
1950	Department of Pharmacy, Madras Medical College, Chennai	Medical College	B. Pharm, M Pharm
1950	Birla Institute of Science and Technology, Pilani	Private University	B. Pharm, M Pharm, PhD
1951	College of Pharmaceutical Sciences, Andhra University, Visakhapatnam	State University	B. Pharm, M Pharm, PhD
1952	Dept. of Pharmaceutical Sciences, Dr. H.S. Gour University, Sagar	Central University	B. Pharm, M Pharm, PhD
1956	Department of Pharmaceutical Sciences, Nagpur University, Nagpur	State University	B. Pharm, M Pharm, PhD
1958	Pharmaceutical Dept., University Institute of Chemical Technology, Mumbai University, Mumbai	State University	B. Pharm Sci, M Pharm Sci, PhD (Tech)
1963	Dept. of Pharmaceutical Technology, Jadavpur University, Kolkata	State University	B. Pharm, M Pharm, PhD

1.2 USA

Early in the 1990s, the curriculum of pharmacy schools and colleges in the United States was expanded to incorporate an additional year of clinical experience in an attempt to graduate pharmacists who were patient-focused. In the United States, the only degree awarded to graduates of professional pharmacy schools is now a Doctor of Pharmacy (PharmD) rather than a Bachelor of Pharmacy. Adopting pharmacological care has at least two significant advantages [9]. First, if pharmacists are successful in preventing drug mishaps among their patients by giving them excellent care, this could lead to a major reduction in emergency issues and physician visits as a result of medication compliance, adherence and timely identification of different interactions. Johnson and Bootman estimated the cost of drug-related issues in the US to be between US$80 and US$150 billion using data from the early 1990s. More reason cost data and a decision analysis model were used in a later study. The authors concluded that $177.4 billion was spent on drug-related problems and casualties in the United States in 2000 [10]. Significant drug-related issues revealed several mishaps, including incorrect medication selection, negative drug reactions, and drug interactions, that chemists can prevent. Pharmacists who are skilled in providing pharmaceutical care to their patients would therefore graduate from the pharmacy programme with a higher quality, and the country's medical and healthcare system may save a substantial amount of money as well. Enhanced legitimacy for the pharmacy profession is the second benefit of pharmacists adopting pharmacological care [11]. Community pharmacies have historically fought against being perceived as a marginal profession due to their location and other provisional stores that sell everything from cigarettes to soft drinks, as well as the general public's belief that pharmacists mostly fill prescriptions that doctors write. The validity of chemists as drug therapy experts may rise with increased visibility [12]. As chemists take on more responsibilities related to pharmaceutical care, there is a lot more potential for ethical dilemmas to arise because every patient is different and could need a non-standard approach to get the best results from their medication. Pharmacists who possess superior conceptual skills to manage ethical uncertainty, a significant aspect of pharmaceutical and therapeutic

care, may be more proficient and offer superior care compared to those lacking such tools [13]. According to Kohlberg, the field of moral reasoning psychology examines how individuals make decisions before reaching a final judgment, which is an important part of Cognitive Moral Development (CMD) [14].

Healthcare services in the US face increasing difficulties. A sizeable section of the population lacks insurance coverage despite changes to laws and coverage aimed at lowering costs and insuring more people. In addition, healthcare costs in the US are expected to increase by 5.5% between 2018 and 2027 and continue to account for a sizeable share of the country's GDP. A concentrated effort by patients with chronic diseases to follow their medication regimen and the release of new treatments are predicted to drive up prescription drug expenditures by an average of 6.1% annually over the same period [15]. One of the most important roles in enhancing medication adherence is community-based chemists. An important consideration in the ongoing evolution of the US healthcare system is quality and outcomes as a means of effectively and economically controlling costs. There is a current scarcity of healthcare professionals, and future shortages in primary care are expected to worsen [16]. It is projected that by 2030, the US will have a physician shortfall of at least 43,000 primary care physicians and 140,000 physicians overall [17]. However, community-based chemists can assist in resolving this issue. According to estimates from the US Bureau of Labour Statistics, more than 186,000 community-based pharmacists are present in the US [18]. The importance of chemists is becoming more widely acknowledged as the US healthcare system evolves and as efforts to improve healthcare are made [19]. As it will show in Figure 2.

Figure 2: Pharmacy Practice Model Initiative: Case Study in Health- System Pharmacy

1.3 GERMANY

Germany's pharmacy industry has seen a fast transformation, with pharmacists now offering patient-centred care in addition to the custom of distributing medications for both ambulatory and inpatient treatment. Numerous initiatives involving pharmacist-delivered medicine treatments have been effectively implemented in community environments [20-21-22-23]. Pharmacists are integral members of interdisciplinary teams in many hospitals, where they assist with medication reviews, do ward rounds, gather medication histories, and offer discharge counselling [24-25-26-27]. The 2012 revision of the Ordinance on the Operation of Pharmacies, which includes medication therapy management as a pharmaceutical task, further demonstrates the shift towards patient-centred care [28]. The recently developed vision statement called "Pharmacy 2030," by the Federal Union of German Associations of Pharmacists (ABDA) encompasses the traditional role of a pharmacist in dispensing medication and also a new concept of physician and pharmacists sharing responsibility for patient drug therapy in Germany [29]. Additionally, the ABDA released a policy paper recently regarding drug management and regimen

review.[30] However, Germany still has to go long way before high-quality services in clinical pharmacy and widely accepted as the standard in healthcare, as evidenced by the low ratio of hospital pharmacists (0.37) to 100 patient beds and the absence of payment-centred patient care in community pharmacies. Pharmacists are being forced to take on more and more new responsibilities as a result of these constant developments [31]. For the upcoming generation of chemists to take on these novel issues and actively advance the profession, new clinical competencies and abilities need to be taught in academic education in German clinical pharmacy through innovative teaching methodologies. In the past, pharmacy education in German universities has tended to be more focused on the drugs themselves than on clinical applications and patient care. This changed in 2001 when the national pharmacy curriculum included a new course called "Clinical Pharmacy" to better align learning objectives with the patient-centred clinical skills that chemists need to practise [32].

When compared to other European nations, within German hospitals clinical pharmacy services seem to be undeveloped. On the other hand, new advancements have raised the need to grow these services. There is a dearth of detailed information regarding the situation of clinical pharmacy services in Germany today. The current state of pharmacy services in Germany is determined by this survey, along with implementation challenges [33]. In the Federal Republic of Germany, spending on public health insurance includes a significant number of pharmaceutical products. German lawmakers have controlled public pharmacies for a long time to prevent prices from rising too much. The primary goal of each reform that has come before it is to boost competition in the pharmacy industry. It's commonly believed that more competition will result in lower healthcare prices. Nevertheless, actual evidence of a more competitive orientation of German public pharmacies is still lacking [34].

The network of around 1,900 hospitals, 150,000 ambulatory care physicians, and 19,000 community pharmacies makes up the German healthcare system. All ambulatory medical care is provided by primary care doctors who are part of regional associations and treat patients who are covered by SHI. The regional associations use the SHI funds to bargain prospectively for their members' overall budgets, and they reimburse doctors for services rendered every quarter [35]. 14% of doctors work in offices and are general practitioners [36]. Patients with health concerns commonly make their first appointment with general practitioners or community pharmacies. Generally speaking, patients have the freedom to select their emergency service, dentist, pharmacy, and physician (including general practitioners and specialists). There are many healthcare professionals per resident in the German ambulatory sector, which contributes to improved accessibility to care [37].

Nonetheless, physician hopping is noted as a result of the absence of a systematic gatekeeper system, particularly in primary care [38]. One important element of the German healthcare system is community pharmacy. Apart from administering medication, pharmacists and pharmacy technicians offer guidance on dosage, usage, possible side effects, and drug interactions. This is combined with recommendations on healthy living and lifestyle, such as nutrition counselling and preventive care [39]. Of the roughly 67,000 pharmacists employed in 2019, more than 52,000 worked in community pharmacies.

All community pharmacies are owned and operated by pharmacists due to a prohibition on third-party pharmacy ownership. One pharmacist must serve as the mandatory subsidiary manager for each of the three subsidiaries that a pharmacist may run adjacent to their primary pharmacy [40].

Germany differs from other countries in that it lacks drugstore chains, with the German Pharmacy Act mandating pharmacy licensing. Despite no state regulations on factors like population density or drugstore numbers, there has been a consistent decline in community pharmacies since 2009. In 2019, there were 19,075 community pharmacies, including 4,602 subsidiaries. The ratio of pharmacies to population stands at around 23 per 100,000 people, below the EU average for its 320,000 inhabitants. This trend will be illustrated in Figure 3.

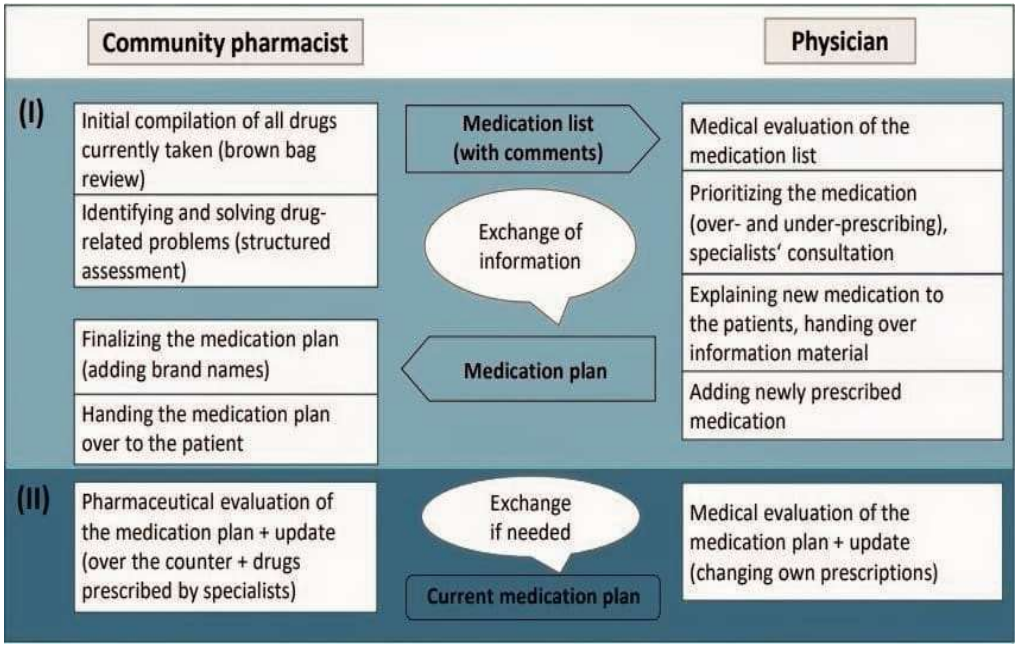


Figure 3: The Medication oversight process within ARMIN consists of two pivotal phases - (1) Initial Intervention; (2) Continuous management

1.4 CANADA

Clinical pharmacy is a discipline that focuses on creating new knowledge to enhance patients' health as well as living quality [42]. Pharmacists are expected to research to further their field and, more importantly, to enhance patient care [43]. Pharmacy practice residencies offer a vital chance for research training and mentorship. To be eligible for publication, pharmacy residents in recognized programs in Canada are required to complete a research project at the time of residency year [44]. Projects require a significant time and effort commitment from each resident, with a maximum of 10 weeks set out for project work. Because there are more than 150 residency opportunities available in Canada each year, residents produce a significant amount of research [45]. Publication is essential for sharing research findings. After a study is published, other people can examine the procedures used, implement the conclusions, or modify any algorithms or process trees created during the investigation. Furthermore, smaller research could be combined for meta-analyses or systematic reviews. Publication benefits the resident and coauthors, the residency programme, and the institution in addition to the project's clinical and scientific significance. Publication enhances the standing of related institutions and residency programmers.[46] and preceptors' participation in this process broadens their publishing experience and could help with subsequent publications [47].

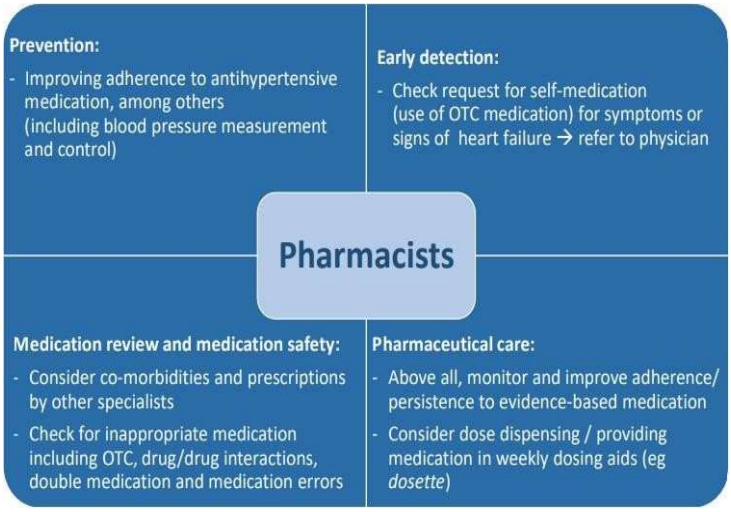
Following investigations and publications, chemists have been called an "underutilised profession" and an "untapped resource" in the medical field since 1980 [48-49]. Pharmacy practice in Canada is still shifting from a product focus to a patient focus due to increased demand for accountability for results, more awareness of patient safety, and increased attention to the prudent use of scarce health resources [50]. Over the past ten years, there has been a considerable transformation in the Canadian pharmacy education system, and this movement will continue as pharmacists' roles within the healthcare system change [51]. Four essential components define the health professional education system in Canada(1) a robust, Research-intensive public university system;(2)a government-funded universal health care system; (3) a health care professional regulatory system based on the UK-style "college" system; and (4) autonomous but extremely cooperative advocacy, educational, and regulatory organizations To comprehend the reasons behind the current state of the Canadian pharmacy education system, it is crucial to acknowledge the significance of these four fundamental components in determining educational policies and practises.

These factors have essentially shaped Canadian pharmacy education and have vital role in the emergence of several noteworthy trends for more than 40 years, such as: (1) an unusually high rate of foreign-trained pharmacists, to supplement the workforce with domestic education;[52] (2) Supported adoption and government

regulation mandate of interprofessional practices, which includes impending changes in liability allocation [53] (3) Modifications to regulations about the area of practice for health care providers, including chemists [54].

Certified pharmacists fill most Canadian prescriptions in community pharmacies. Pharmacists may be best suited to identify and address medication assurance [55]. Community pharmacies vary in location, ownership, and dispensing. These organizational policies may affect some patients' medication habits. The impact of community pharmacy models on drug adherence are unclear. Independent pharmacy may provide better service. However, objective facts do not support these findings. Kalsekar et al. found that independent pharmacies had a somewhat higher adherence rate for oral hypoglycaemic drugs than chain pharmacies [56-58]. Adherence was measured only for two pharmacies, and patients who quit therapy were excluded. A second trial by White et al. found that mail-order patients adhered better to statins than neighbourhood pharmacy patients. The comparison focused on one mail-order drugstore that offered financial incentives for using this service. No distinction was made between community pharmacies used for comparison [59]. Medication nonadherence is common and linked to poor patient outcomes. Figure 4 [60-61].

Figure 4: Pharmacists' responsibilities assigned through National Disease Management



2. A comparative investigation into the curriculum frameworks of Pharmacy Education Regulation in India and different countries.

2.1 Pharmacy Council of India (PCI) provided curriculum and syllabus of India [62]

The updated regulations for the B. Pharm. Degree Program (CBCS) of the PCI, New Delhi, are effective from the Academic Year 2016-17. The Pharmacy Council of India may modify these regulations in the future. In order to be admitted into the first year of the B. Pharm program, applicants must have successfully finished the 10+2 examination that is acknowledged by the appropriate state/central government authorities. This examination should include English as a subject, as well as Physics, Chemistry, Mathematics (P.C.M.), and/or Biology (P.C.B/P.C.M.B.) as optional subjects, each taken separately. Furthermore, the Pharmacy Council of India accepts any other certification that is considered equal. In order to be eligible for lateral entrance into the third semester of the B. Pharm program, candidates must have completed the D. Pharm course from an institution that is approved by the Pharmacy Council of India under section 12 of the Pharmacy Act. The B. Pharm program consists of eight semesters for normal entry students, which is equivalent to four academic years. For lateral entrance students, the program is completed in six semesters, which is equivalent to three academic years. The curriculum and syllabi are periodically determined by the Pharmacy Council of India, located in New Delhi.

The program's instruction and examination are conducted solely in the English language. Every semester must consist of at least 100 working days. Odd semesters span from June/July to November/December, whereas even semesters span from December/January to May/June in each calendar year. Candidates must have a minimum of 80% attendance in both theory and practical courses, as stipulated by the attendance criteria. In addition, candidates must successfully fulfil the requirements of the given course to qualify for the corresponding examinations. The Credit Semester System quantifies academic delivery, such as theory classes, tutoring hours,

and practical classes, in terms of credits, by its principles. Upon the satisfactory completion of courses, applicants accrue credits. The credit distribution for each course is decided based on the weekly instruction hours. One credit is provided for lecture and tutorial hours, while half a credit is assigned for practical (laboratory) hours. As an example, a theory course that consists of three lectures and one tutorial per week for the entire semester is worth four credits. On the other hand, a practical course that requires four hours of laboratory work per week for the entire semester is worth two credits.

The minimum credit point requirement is 208 for B. Pharm. Allocation of credits through theory courses, tutorials, practical, practice school, and projects over eight semesters, as outlined in Table IX. Courses are sequenced to progressively develop competencies, with their positioning indicating the academic maturity expected from learners. Students are expected to adhere to the semester-wise schedule of courses provided in the syllabus. 52 credit points are transferred to students having lateral entry to their D. Pharm program. Additionally, remedial courses must be completed in Communication Skills and Computer Applications in Pharmacy to attain a total of 59 credit points by the end of the first two semesters. Attendance records in both theory and practical sessions must be maintained throughout the session by the teaching staff of the subjects assigned to them [62].

Table I outlines the course of study for Semester I with the specified course codes (BP-101T for Theory and BP-101P for Practical), as per the regulations of the Pharmacy Council of India [62]:

Course Code	Course Title	Type	Hours/Week	Credits
BP-101T	Pharmaceutical Analysis-I	Theory	3	3
BP-102T	Pharmaceutical Chemistry-I	Theory	3	3
BP-103T	Pharmaceutics-I	Theory	3	3
BP-104T	Anatomy, Physiology & Health Education	Theory	3	3
BP-101P	Pharmaceutical Analysis-I	Practical	3	1.5
BP-102P	Pharmaceutical Chemistry-I	Practical	3	1.5
BP-103P	Pharmaceutics-I	Practical	3	1.5
BP-104P	Anatomy, Physiology & Health Education	Practical	3	1.5
BP-105T	Remedial Biology and Mathematics for Pharmacy	Theory	3	3
BP-106T	Communication Skills in English	Theory	3	3
BP-107T	Computer Applications in Pharmacy	Theory	3	3
BP-108T	Environmental Sciences and Green Chemistry	Theory	3	3
BP-113T	Environmental Sciences and Green Chemistry	Practical	3	1.5
BP-114T	Computer Applications in Pharmacy	Practical	3	1.5
BP-115T	Communication Skills in English	Practical	3	1.5
BP-116T	Remedial Biology and Mathematics for Pharmacy	Practical	3	1.5

US Pharmacy Syllabus [63]

Table 3 represents the course title, course code and description of the US Pharmacy syllabus for 1st semester

Course Title	**Course Code**	**Description**
Introduction to Pharmacy Practice	PHAR 101	Introduction to the pharmacy profession, including history, scope, ethics, and legal regulations.
Pharmaceutical Chemistry	PHAR 102	Basic principles of organic and inorganic chemistry relevant to pharmacy, including chemical bonding and functional groups.
Human Anatomy and Physiology	PHAR 103	Study of the structure and function of the human body, with relevance to pharmacy practice.
Pharmacology	PHAR 104	Introduction to drug classification, mechanisms of action, pharmacokinetics, and pharmacodynamics.

Pharmaceutical Calculations	PHAR 105	Basic mathematical calculations and concepts applicable to pharmacy practice, including dosage calculations and compounding.
Introduction to Pharmacy Ethics	PHAR 106	Exploration of ethical principles in pharmacy, including patient confidentiality and professional integrity.
Pharmacy Communication Skills	PHAR 107	Development of effective communication skills for pharmacy practice, including patient counselling and interprofessional communication.
Introduction to Pharmacy Research	PHAR 108	Introduction to research methodology and critical appraisal skills relevant to pharmacy practice.
Pharmacy Seminar	PHAR 109	Interactive sessions focusing on contemporary issues and developments in pharmacy practice.
Introduction to Healthcare Systems	PHAR 110	Overview of the US healthcare system, including healthcare organizations, financing, and regulatory agencies.

Germany Pharmacy Syllabus [64]

Table 4 represents the course title, course code and description of the US Pharmacy syllabus for 1st semester

Course Title	Course Code	Credits	Description
Introduction to Pharmacy	PHAR 101	5	Overview of the pharmacy profession, history, and scope of practice
Pharmaceutical Chemistry I	PHAR 102	7	Fundamentals of organic chemistry, molecular structure, and bonding
Human Anatomy and Physiology	PHAR 103	6	Introduction to human body systems, organs, and functions
Basics of Pharmacology	PHAR 104	6	Introduction to pharmacodynamics, pharmacokinetics, and drug classifications
Pharmacy Calculations	PHAR 105	4	Mathematics and calculations related to pharmaceutical formulations and dosages
Pharmaceutical Microbiology	PHAR 106	5	Introduction to microbiology with a focus on pharmaceutical applications
Introduction to Pharmacy Ethics	PHAR 107	3	Ethical principles and considerations in pharmacy practice and research
Pharmacy Communication Skills	PHAR 108	3	Developing effective communication skills for pharmacy professionals
Introduction to Pharmacy Research	PHAR 109	4	Basic research methodologies in pharmacy, literature review, and research ethics
Pharmacy Seminar	PHAR 110	2	Interactive sessions covering current topics, case studies, and professional development
Introduction to Healthcare Systems	PHAR 111	4	Overview of healthcare delivery systems, policies, and stakeholders in Germany

3. The challenges faced by pharmacists in each setting, such as medication shortages, drug pricing, and regulatory compliance. Pharmacist Challenges Assessment

Pharmacists play a crucial role in healthcare settings, including community outreach pharmacies, primary clinics, and hospitals. However, they also face several challenges in their day-to-day work. These challenges can vary depending on the specific setting, but some common issues faced by pharmacists include:

3.1 Medication shortages:

Pharmacists often encounter challenges in procuring an adequate supply of medications for their patients. It may be because of various reasons like manufacturing issues, supply disruptions, and regulatory restrictions. The increasing attention given to research on drug shortages in recent years highlights the growing impact it has on the health and well-being of patients [65-67]. Nevertheless, a globally recognized definition for drug shortages has not yet been established. In 2016, the World Health Organization (WHO) developed draft definitions on a global scale to address the increasing occurrence of shortages of drugs and vaccines [68]. The German Federal

Institute for Drugs and Medical Devices (BfArM) defines "delivery shortage" (Lieferengpass) as a situation where there is a disruption in the normal supply volume of drugs lasting for more than two weeks, or when there is a significant increase in demand that cannot be adequately met [69]. Furthermore, when the availability of therapeutic alternatives is compromised due to the absence of appropriate drug treatment, a drug shortage results in a treatment deficiency (Versorgungsengpass).

As a result, drug shortages present significant challenges in patient care and healthcare delivery, impacting healthcare professionals [70-71-72]. Pharmacists have the responsibility to ensure uninterrupted and appropriate treatment for patients. Understanding the root causes of drug shortages and their adverse effects on patient safety from the perspective of pharmacists is crucial for comprehending the current landscape and the emerging implications of shortages in pharmacy practice.

3.2 Drug pricing:

Pharmacists often have to navigate complex pricing structures and reimbursement systems, which can be challenging to understand and manage effectively. The escalation of global healthcare expenditures has been significant, with prescription drug costs emerging as a major contributor [73]. Recent public outrage over exorbitant drug prices has elevated this issue to prominence in the media and political arenas. What was once a matter discussed primarily in academic and governmental circles has now become a topic of widespread societal concern, prompting scrutiny of its public ramifications. The pricing of medications became a focal point during the 2016 U.S. presidential election campaign [74].

3.3 Regulatory compliance:

Pharmacists must comply with numerous regulations and guidelines related to medication dispensing, record-keeping, patient privacy, and more. Failure to stick to these regulations can result in legal actions and potential harm to patients.

Numerous instances of exorbitant drug prices have garnered widespread attention in the media, spanning various therapeutic categories and geographic regions. One frequently cited example is imatinib, a medication used for chronic myeloid leukaemia, which experienced a threefold increase in price following approval for a new indication by the US FDA. Despite significant sales volume growth, Novartis increased the amount from $31,930 in 2005 to $118,000 per year in 2015. Despite factoring in the research expenses for the additional indication during the initial pricing, there was still a significant price increase. In the United States, the drug sofosbuvir, which is sold under the brand name Sovaldi®, has a price of $84,000 for a 12-week therapy. This translates to a cost of $1,000 per pill. As a result, healthcare insurers are refusing to cover the cost of treatment for hepatitis C virus (HCV) infection. In 2014, Sovaldi® accounted for 64% of the total money spent on therapies for the Hepatitis C Virus (HCV) in the United States, which equated to $12.3 billion [77]. While Sovaldi® may offer cost-effectiveness by preventing the need for liver transplants, the financial burden is deemed unsustainable by US insurers, making it inaccessible to many HCV patients [78]. Likewise, in Spain and Latvia, the cost of a course of Sovaldi® treatment was deemed unbalanced by key stakeholders, prompting concerns among pharmacists and pharmaceutical policy authorizers. Although alternative treatments like ledipasvir/sofosbuvir (marketed as Harvoni®) offer comparable efficacy, the high prices of HCV medications are not isolated incidents [79].

3.3 Limited support from physicians:

In some cases, pharmacists may face resistance or lack of support from physicians in their practice. This can hinder collaboration and effective patient care. The pharmacy profession in developing nations is still in the process of gaining recognition [80]. In these countries, pharmacists primarily engage in tasks related to drug procurement, manufacturing, dispensing, and managing the drug supply chain [81]. Despite being valued and compensated in pharmaceutical industries [80], pharmacists in underdeveloped countries do not yet hold significant roles in pharmaceutical care services or clinical practice [82]. In contrast to developed countries pharmaceutical care is integral to healthcare systems [83]. In developing countries, pharmacists have limited involvement in patient care activities, including infection control, immunization, chronic illness management, and public health efforts [84]. Additionally, their contribution to rational medicine use initiatives is minimal. As a result, pharmacists in these regions are not utilized properly, with their education and training, and their potential to enhance patient care remains untapped, representing missed opportunities to improve public health in

developing countries.

Meanwhile, in developed nations, pharmacists play extensive and established roles in healthcare [85]. Countries such as the US, UK, Canada, Australia, and New Zealand have well-developed pharmaceutical care services delivered by pharmacists [86-87]. These services have demonstrated valuable outcomes in community and hospital settings [86- 87]. Pharmacists in the following countries receive comprehensive education and training, enabling them to provide high-quality pharmaceutical care [88]. Consequently, they are recognized as integral members of healthcare teams [89], and their expanded roles are accepted by physicians and other healthcare professionals, leading to improved patient care [90- 91]. Public trust in pharmacists is evident from the numerous medication management interventions reported [92].

For instance, in Australian hospital emergency departments (ED), clinical pharmacists are directly involved in patient care [93]. Their interventions, highly valued by ED and nursing staff, contribute significantly to patient outcomes. Similarly, community pharmacies play a crucial role in healthcare in developed nations [87], where pharmacist interventions have been shown to reduce prescription errors [94].

4. Discussion

Initially, the curriculum aimed to train graduates for specialized roles in pharmaceutical corporations, focusing on quality control and standardization of medications rather than direct pharmacy practice. Over time, a variety of pharmacy degree programs have been established in India, including D. Pharm, B. Pharm, M. Pharm, M. Tech (Pharm), master's program in pharmacy science (MS(Pharm)), PharmD, and doctor of philosophy in pharmacy (PhD) [95].

Notably, the Pharm.D. program stands out for its clinical orientation, emphasizing patient-centred care. Pharm.D. graduates are trained to provide personalized patient counselling, offering guidance on medication usage, dosage schedules, pharmacological mechanisms, potential side effects, disease manifestation, and the importance of treatment adherence. This approach places a strong emphasis on addressing individual patient needs and ensuring optimal health outcomes [96]. Conversely, M. Pharm and B. Pharm programmes are focused on the industry and discuss topics such as drug formulation, the investigation of various drug sources, the chemical structure of pharmaceuticals, the stages involved in drug synthesis, drug synthesis methodologies, drug analysis, pharmacological effects of drugs, and so forth.

In South Africa, a PharmD degree is favoured over the B. Pharmacy qualification. Success in providing exceptional patient care by pharmacists could potentially lead to a significant decrease in emergency room visits and physician consultations due to issues such as adherence problems, interactions, and drug-disease complications [97]. The healthcare system in the United States is grappling with increasing challenges, including a significant population proportion lacking adequate insurance policy coverage despite efforts to reform the healthcare system and expand reportage to individuals.

In Germany, the 2012 revision of pharmacy regulations emphasizes drug therapy management as a prime responsibility, reflecting a shift towards patient-centred care. The vision outlined in "Pharmacy 2030" extends beyond traditional dispensing roles to include collaborative medication therapy management between medical doctors and pharmacists by the Federal Union of German Associations of Pharmacists (ABDA). Compared to other European countries, clinical pharmacy services within hospitals appear to be less developed. However, the ambulatory sector benefits from a higher ratio of healthcare professionals per resident, enhancing accessibility to care [98]. Germany's pharmacy landscape differs from other nations, as the country does not have drugstore chains. The German Pharmacy Act mandates licensing for operating a pharmacy, ensuring adherence to regulatory standards and quality of care [99].

Pharmacy residency programs in Canada present valuable opportunities for research training and mentorship. Eligibility for publication requires the completion of the research project as a pharmacy resident during their residency year. Pharmacy education in the Canadian system has gone through a significant change over the last decade, reflecting the evolving roles of pharmacists within the healthcare system. Four key components shape the Canadian health professional education system: a robust, research-oriented public university system without private pharmacy schools; a government-funded universal healthcare system with limited private healthcare delivery; a regulatory system for healthcare professionals based on the UK-style "college" system; and autonomous yet collaborative advocacy, educational, and regulatory organizations. Understanding the current state of the Canadian pharmacy education system requires acknowledging the fundamental components in

defining educational policies and practices [100].

5. Conclusion

Pharmacy education in India began formally in 1937 with Banaras Hindu University's introduction of a BPharm program, initially focusing on pharmaceutical corporations' roles. Today, India offers various pharmacy degree programs, including D Pharm, B Pharm, M Pharm, M Tech (Pharm), MS(Pharm), PharmD, and PhD. The Pharm.D. program emphasizes clinical training, prioritizing patient-centred care and counselling on medication use and health outcomes. In South Africa, the PharmD degree is preferred over the BPharm. In the US, healthcare struggles with insurance coverage gaps despite healthcare reforms. Germany's pharmacy regulations stress medication therapy management, envisioning collaborative care between doctors and pharmacists. Although clinical pharmacy in German hospitals is less developed, the ambulatory sector benefits from a higher ratio of healthcare professionals. Unlike other countries, Germany lacks drugstore chains, with the German Pharmacy Act mandating pharmacy licensing. In Canada, pharmacy residencies offer research opportunities, reflecting changes in the pharmacist's role within the healthcare system. The Canadian pharmacy education system is shaped by a robust public university system, universal healthcare, a regulatory structure based on the UK-style "college" system, and collaborative advocacy organizations. Understanding these components is crucial for shaping educational policies and practices in Canada. The pharmacy regulations in India, the USA, Germany, and Canada demonstrate variations tailored to the unique healthcare landscapes and educational systems of each country. While each country has its own set of standards and requirements for pharmacy education and practice, all aim to ensure the delivery of effective and safe pharmaceutical care to patients. Understanding these regulations provides valuable insight into the academic and professional pathways available to aspiring pharmacists in these countries. As the field of pharmacy continues to evolve globally, staying informed about these regulations is essential for maintaining high standards of education, practice, and patient care across borders.

Conflict of Interest

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