



# Pharm.D.s in the Midst of M.D.s and Ph.D.s: the Importance of Pharmacists in Medical Education

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The pharmaceutical industry is booming. According to Forbes magazine, 2015 was a remarkable year for pharmaceutical innovation, in which the number of new drugs approved surpassed every year since 1950 [1]. There has been an exponential growth in biological agents used for targeted therapy, and pharmacogenomics is now transforming drug selection for many disease states. Pharmacology is a challenging subject to teach and learn, and with the record number of 45 new medications approved in 2015 by the U.S. Food and Drug Administration, pharmacology education will only become more challenging [1]. With a steady growth of novel drug treatments, immunologic and biologic agents, and the expanding role of pharmacogenetics, the amount of time devoted to pharmacotherapy education in the medical school curriculum should theoretically increase, but several studies have reported that undergraduate medical pharmacology training is insufficient [2]. Medical students should be provided with appropriate education to ensure optimal clinical outcomes with the prescribed therapy.

According to the American College of Clinical Pharmacy (ACCP), prescribers are not always appropriately educated to administer and monitor currently available therapeutics [2]. ACCP believes there is an urgent need to improve and expand clinical pharmacology education for undergraduate physicians [2]. The World Health Organization also believes that healthcare professionals who prescribe medications need better education in clinical pharmacotherapy to help prevent

prescription errors and reduce the incidence of adverse events [2]. In “Tomorrow’s Doctors,” the General Medical Council’s guidance on undergraduate medical education emphasized the importance of integrating clinical pharmacology and therapeutics teaching within the medical school curriculum [3]. Overall, it seems clear that pharmacology education in the medical school curriculum must improve, as insufficient knowledge about commonly used medications or the confidence to apply this knowledge will make it difficult for our future physicians to provide safe and effective patient care.

Students may not feel confident in their pharmaceutical education for many reasons. Making a connection between the basic biomedical sciences and clinical application to patient cases is challenging. Even practicing physicians and pharmacists often find it difficult to integrate basic science concepts with clinically relevant scenarios. While it is extremely important for students to connect the pharmacology taught at the beginning of the curriculum to the translational application of pharmacotherapeutics taught during their clerkship years, it is often considered an overwhelming task. For example, simply learning about the mechanism of action and adverse effects of a medication does not make it easy to effectively utilize that knowledge in a clinical setting years down the road. Students may also not feel confident in their pharmaceutical knowledge due to a lack of early clinical exposure, in which the development of prescribing skills may require contextual variables presented by real patients, such as comorbidities or challenging home situations [4]. Tichelaar and colleagues found that medical students tend to copy the drug treatment choices of their teachers during clinical clerkships, instead of selecting an appropriate treatment based on their own independent analysis of the patient [5]. A lack in confidence in their ability to independently choose a safe and effective medication may be due to the lack of certainty in their ability to connect the basic and clinical sciences. This could potentially lead to further problems in which medical residents may not feel adequately prepared to prescribe after graduating from medical school [6].

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Clinical pharmacists, experts in drug therapy, can play a key role in improving pharmacology education and increasing the confidence that medical students have in their ability to select appropriate therapy. The knowledge that clinical pharmacists share has led to better use of medications, increased cost-effectiveness, optimized clinical outcomes, and improved patient care [7]. Post-graduate training through residencies and fellowships has allowed many pharmacists to receive extra clinical training. As a result, they are much more involved in direct patient care such as participating in daily rounds with physician teams. In some states, clinical pharmacists are even legally recognized as independent providers [8]. Clinical pharmacists have a comprehensive knowledge of medications, integrated with a foundational understanding of the biomedical, socio-behavioral, and clinical sciences. For these reasons, they can teach students how to provide optimal medication therapy management and help identify patient-specific drug-related problems [9]. With an expanded scope of practice, including more direct patient care responsibilities, clinical pharmacists can help ensure students have a thorough understanding of the basic sciences (i.e., mechanism of action, adverse effects, monitoring parameters). They can also help medical students develop the skills necessary to become proficient prescribers [6]. Essentially, pharmacists may play a very important role in making sure our medical students have a solid foundation of clinical pharmacology and therapeutics, in order to develop optimal prescribing skills and provide the highest quality patient care [10].

One area in which clinical pharmacists can play a significant role is curriculum integration. In the traditional medical school curriculum, basic science courses are taught first, followed by the clinical courses and clerkships. Many medical schools are moving to a curriculum in which the basic and clinical sciences are integrated, through the use of clinical scenarios with standardized patients or through the use of problem-based learning [11]. Medical students have difficulty with the transition from theoretical to clinical education. For example, it has been shown that simply presenting students with a link between a medication and an associated clinical condition is inadequate and will not help students truly understand the complex processes involved in writing appropriate prescriptions. It is thought that early exposure to life-like situations will provide students with immediate opportunities to connect the basic sciences with clinical sciences and increase student learning retention and clinical reasoning skills [11]. Clinical pharmacists can play a key role in vertical integration to help facilitate smooth transition from classroom learning to clinical education [12].

An in-depth knowledge of pharmacotherapy and real-life experiences give clinical pharmacists the ability to help with curriculum integration in many ways. They can provide detailed answers to pharmacotherapy questions and help students tie treatment recommendations into pragmatic

translation for discharge readiness and outpatient prescription filling. They can also write authentic patient case scenarios that review pharmacotherapy-related topics and clinical application questions which clearly illustrate significant medication-related issues. Their extensive knowledge may make them a great choice to collaborate on the development of cases for problem-based learning (PBL), team-based learning (TBL), or simulated or standardized patients [13]. For example, Karpa and Whaley stated that it was useful to have a clinical pharmacist included as a team-based learning facilitator during their TBL on teaching first-order pharmacokinetics, since clinical pharmacy-related questions often arise [14].

Hospital-based clinical pharmacists are a great source for pharmaceutical education while students are learning in the acute hospital setting during their clerkship years. At the University of Missouri-Kansas School of Medicine, clinical pharmacists have the sole responsibility of providing instruction in basic pharmacology and pharmacokinetics. The teaching is done in a true patient care environment, in which the understanding of pharmacotherapy can be enhanced and reinforced after reviewing therapeutic problems encountered by their patients [15]. Often times, hospital pharmacists attend rounds with the medical team, where they provide interventions to optimize medication regimens, prevent adverse drug events, and identify potential downsides to using specific classes of medication based on comorbid conditions. They also help identify barriers to medication adherence. If medical students are able to attend rounds with pharmacists during their clerkship years, they will be given the opportunity to observe and learn from pharmacist interventions, which may help them gain the knowledge and confidence necessary to choosing an appropriate medication regimen. Clinical pharmacists can be an important factor in making sure students are capable of appropriately evaluating the risks and benefits when prescribing different medications in a real-life setting. They can teach proper monitoring strategies for increased patient safety, provide instruction on safe medication prescribing practices, and provide education on the required components on a prescription [16].

Student assessment and evaluations are other areas in which pharmacists can be significant assets. It has been stated that the assessment of medical students' pharmaceutical knowledge needs improvement. For example, Urrutia-Aguilar and colleagues suggested that stronger assessments are necessary for pharmacology education, since positive student ratings for teacher effectiveness did not correlate with good objective exam scores [17]. O'Shaughnessy and colleagues also stated that most schools do not assess the performance of their graduates as prescribers and that there is a lack of evidence about the effectiveness of many of the methods used to teach prescribing skills today, in which validated real-world assessments are needed [3]. One example of an evaluation that needs significant improvement is a student's

pharmaceutical knowledge for appropriate prescription writing. It is known that many new physicians feel unprepared for their prescribing role [10]. In a study on undergraduate preparation for prescribing, both medical students and recent graduates felt that the amount of teaching in pharmacology, therapeutics, and prescribing was either “too little” or “far too little.” Of the same students, 42% disagreed or tended to disagree when asked if they felt confident that their training would enable them to achieve the prescribing competencies set by the General Medical Council [18].

Communication and working relationships between physicians and pharmacists have often been cited as barriers to good interprofessional relationships. There are many reasons for this, including the role of receptionists as a “gatekeeper.” Physicians may be unaware of the training of pharmacists and may perceive pharmacists as a threat to their autonomy and control [7]. The use of pharmacists early in the medical school curriculum may help enhance and foster the development of interprofessional relationships between these two professions. In healthcare, multidisciplinary teams are now considered “best practice” for providing high-quality care. On multidisciplinary teams, many different healthcare professionals, such as physicians, nurses, and pharmacists, work together in order to provide appropriate treatment recommendations to best meet the patients’ needs. It is thought that pharmacist involvement in medical education could help encourage a cultural change towards this multidisciplinary approach, in which an early introduction to interprofessional learning may allow for an increased understanding of the importance of pharmacists and better professional relationships [10]. New physicians may feel more comfortable asking pharmacists for help solving various medication-related issues if they have a clear understanding of their role in the provision of healthcare. In the end, this could be a great way to improve patient outcomes.

Although clinical pharmacists will not solve all issues related to pharmacology education, they can be an important asset in improving pharmacology instruction and assessment. Clinical pharmacists can and should play an important role in enhancing the curriculum by improving pharmacotherapy education, as they can share their pharmaceutical knowledge and help medical students apply that knowledge to real-life scenarios. The expertise that pharmacists have in all areas of drug therapy gives them the ability to help create more effective active learning strategies and assessments for pharmacology-related topics. Through interprofessional education by clinical pharmacists, medical students can gain confidence in their pharmaceutical knowledge and succeed in their future prescribing role.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that there is no conflict of interest.

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