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Evolution of Preprofessional Pharmacy Curricula

Abstract

Objectives. To examine changes in preprofessional pharmacy curricular requirements and trends, and determine rationales for and implications of modifications.

Methods. Prerequisite curricular requirements compiled between 2006 and 2011 from all doctor of pharmacy (PharmD) programs approved by the Accreditation Council of Pharmacy Education were reviewed to ascertain trends over the past 5 years. An online survey was conducted of 20 programs that required either 3 years of prerequisite courses or a bachelor's degree, and a random sample of 20 programs that required 2 years of prerequisites. Standardized telephone interviews were then conducted with representatives of 9 programs.

Results. In 2006, 4 programs required 3 years of prerequisite courses and none required a bachelor's degree; by 2011, these increased to 18 programs and 7 programs, respectively. Of 40 programs surveyed, responses were received from 28 (70%), 9 (32%) of which reported having increased the number of prerequisite courses since 2006. Reasons given for changes included desire to raise the level of academic achievement of students entering the PharmD program, desire to increase incoming student maturity, and desire to add clinical sciences and experiential coursework to the pharmacy curriculum. Some colleges and schools experienced a temporary decrease in applicants.

Conclusions. The preprofessional curriculum continues to evolve, with many programs increasing the number of course prerequisites. The implications of increasing prerequisites were variable and included a perceived increase in maturity and quality of applicants and, for some schools, a temporary decrease in the number of applicants.

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RESEARCH

Evolution of Preprofessional Pharmacy Curricula

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Keywords: prepharmacy curriculum, prerequisites, admissions

INTRODUCTION

Accreditation Council for Pharmacy Education (ACPE) accreditation standards and guidelines stipulate a minimum of 2 academic years or the equivalent college-level coursework prior to admission into PharmD programs. The standards and guidelines call for the curriculum to include training in basic and physical sciences, mathematics, information and communication technologies, in addition to sufficient general education, including humanities, behavioral and social sciences,

and communication skills.¹ ACPE does not, however, prescribe specific courses, credit hours required of preprofessional curricula, or desired abilities or outcomes that should be achieved through preprofessional education.² Consequently, preprofessional requirements vary greatly among programs.

In 2009, as commissioned by the Academic Affairs Committee of the American Association of Colleges of Pharmacy (AACP) for its Curricular Change Summit, Boyce and Lawson put forth recommendations for preprofessional pharmacy curricula, including 2 models—a fundamental curriculum and an extended curriculum.³ This white paper provided an analysis of student abilities needed to enter PharmD programs, along with evidence-based guidelines for revising the preprofessional program to promote student academic, professional, and societal success.

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The proposed fundamental preprofessional curriculum model would consist of: (1) a liberal arts education that includes courses in English composition, psychology, sociology, economics, public speaking or interpersonal communications, and general education requirements consisting of US culture and international studies; (2) a strong foundation in science and mathematics that includes general biology and microbiology, anatomy and physiology, general and organic chemistry, calculus, physics, and statistics, along with development of inquiry and the scientific method; and (3) activities to foster a general appreciation of pharmacy as a health sciences profession, such as students working or volunteering in a pharmacy or other healthcare setting. Additionally, exposure to cultural competence and diversity awareness, ethics, moral reasoning, group collaboration, and critical thinking should be integrated throughout the preprofessional program. The duration of the fundamental curriculum is expected to require a minimum of 5 semesters of coursework for most students.³

In addition to the components listed above, the extended curriculum model is proposed to also include additional science courses, including biochemistry, genetics, and possibly immunology, and macro- and microeconomics. This extension would require a minimum of 6 semesters of coursework and would likely lead to students deciding to complete a baccalaureate degree in 8 semesters. The completion of such a degree is viewed as an enhancement of students' general abilities and maturity, as well as a demonstration of their ability to complete an academic program.³

Most US colleges and schools of pharmacy require 2 years of preprofessional coursework prior to entering the PharmD program. According to 2012-2013 Pharmacy School Admissions Requirements data, the average number of required preprofessional semester hours among reporting colleges and schools is 67.6.⁴ However, to make room for new accreditation requirements in pharmacy curricula, such as extended introductory pharmacy practice experiences (IPPEs), some colleges and schools have moved coursework traditionally completed during the professional program, such as biochemistry and microbiology, to the preprofessional program. With this change, some colleges and schools are moving toward 3-year preprofessional requirements and others are requiring or preferring a 4-year bachelor's degree. Likewise, pharmacy college and school applicant data showed that 76.7% of applicants had 3 or more years of postsecondary education. Of this percentage, 31.3% had completed 3 or more years of postsecondary education without earning a degree; 42.5% held a baccalaureate; 2.6% held a master's degree; and 0.3 percent held a doctorate.⁵

Reports in the pharmacy literature have evaluated various predictors of academic success in PharmD programs, including attainment of a bachelor's degree prior to entering pharmacy school. Chisholm and colleagues concluded that prior attainment of a 4-year college degree was 1 of the most important factors in predicting academic performance in first-year pharmacy students.⁶ Prior attainment of a bachelor's degree was a positive predictor of academic success in pharmacy college or school.⁷ Coursework in advanced biology and a degree in science were significantly associated with academic success.⁸ Despite these findings, academic pharmacy administrators are still divided on the ideal length of the preprofessional program.⁹

Given the lack of specific preprofessional curricular requirements from ACPE and the variation of preprofessional curricular requirements among US PharmD programs, this study aimed to: (1) report on recent trends in structure and requirements of preprofessional curricula; (2) examine the rationale of PharmD programs for changing preprofessional requirements; and (3) report the implications (eg, effects on applicant pools, higher/lower quality of students entering into professional program) of preprofessional curriculum changes.

METHODS

This project was developed as a component of AACP's Academic Leadership Fellows Program. Prior to beginning this study, institutional review board (IRB) approval was obtained from the committees at the investigators' respective institutions. A mixed methods design¹⁰ was used to triangulate quantitative and qualitative data collected, as depicted in Figure 1. This method provided a more detailed view of selected participating PharmD programs to help explain quantitative results and provide a deeper understanding of the views of various pharmacy programs regarding their prerequisites.

To ascertain recent trends in preprofessional curricula, prerequisite data of all ACPE-accredited PharmD programs collected by AACP annually between 2006 and 2010 were reviewed.¹¹⁻¹⁵ After the design and initiation of this study, AACP released 2011-2012 prerequisite data, which was subsequently included in the trend analysis.¹⁶ Upon further review of the prerequisite data, discrepancies were found in the reported length of preprofessional requirements for a small number of programs. Thus, the prerequisite data were subsequently confirmed by directly contacting program representatives or consulting institutions' Web sites to ensure accuracy in the trend analysis.

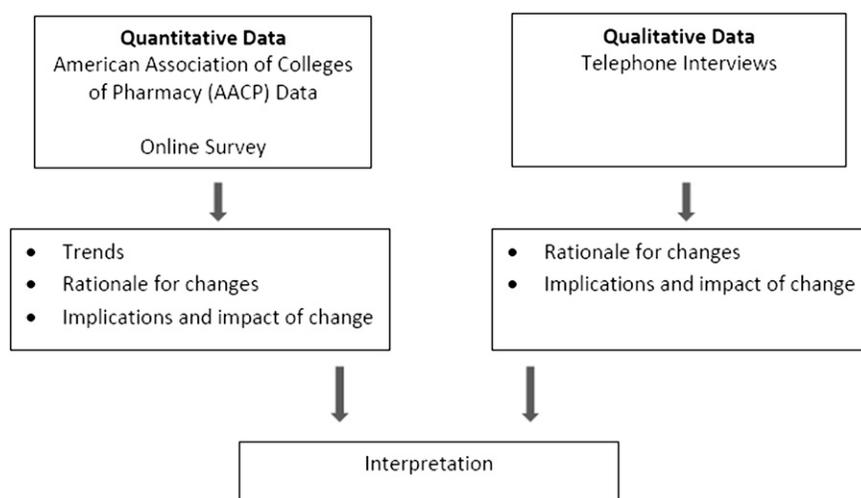


Figure 1. The Mixed-Methods Design of a Study of Changes in Prerequisite Curricula for Doctor of Pharmacy Programs.

PharmD programs were placed into 1 of 3 categories: programs that required 2 years of prerequisite courses, those that required 3 years of prerequisite courses, and those that required a bachelor's degree before admittance into the PharmD program. For the purpose of this study, to differentiate between 3-year prerequisite programs and 2-year prerequisite programs, 3-year prerequisite programs were defined as those that required 5 or more semesters or 75 semester credit hours or more of coursework, as this was deemed a reasonable cutoff of semester credit hours using an 18-credit-hour maximum per semester.

According to the initial review of AACP data, as of 2010, 20 PharmD programs were identified as requiring either 3 years of prerequisite courses or a bachelor's degree for entry. This cohort included programs that were newly established between 2006 and 2010 as 3-year or bachelor's degree prerequisite programs, programs that increased their prerequisites to 3 years or a bachelor's degree during that timeframe, and long-standing programs that maintained a 3-year or bachelor's degree requirement from 2006 to 2010. Next, in an attempt to achieve a balanced representation in the sample, all 2-year programs whose prerequisites remained unchanged were categorized into public and private institutions and a random numbers table was used to select 10 programs from each category. These 40 programs were surveyed to examine rationales for and implications of changing or not changing prerequisites.

The online survey instrument, sent to deans of the 40 PharmD programs, consisted of 12 closed-ended questions with defined responses, along with opportunities for free-form written comments. Survey instruments were completed on the Internet using a modified Dillman technique.¹⁷

In February 2012, the dean at each of the PharmD programs selected to participate in this study was sent an e-mail invitation. Four days later, the dean at each program received a link to a Web-based survey instrument and was instructed to forward the e-mail to the admissions director and/or another individual in the program who was familiar with admissions issues. Recipients were given 10 days to complete the survey instrument. At that point, a reminder was sent only to the deans of programs from which no survey instrument had been completed and returned, giving them another 10 days to complete the online survey instrument. A second reminder was sent only to deans of programs from which a completed survey instrument had not been received after 20 days. The survey was closed after another 10 days.

Subsequently, standardized telephone interviews were conducted with representatives of selected PharmD programs, sampled by convenience. Programs were selected based on investigator knowledge of recent changes in prerequisites or recent consideration of prerequisite changes at the program, or if the program was represented among AACP's 2011-2012 Academic Leadership Fellows Program cohort. Nine PharmD programs were selected for the interview stage of the study: 3 programs requiring 2 years of prerequisite coursework, 3 programs requiring 3 years of prerequisite coursework, and 3 programs requiring a bachelor's degree. All but 2 programs selected for telephone interview had also received the online survey instrument. Three separate sets of interview questions were developed, varying based on the respective level of prerequisites required. Each interview was recorded and conducted either face-to-face or over the telephone. All recorded interviews were transcribed to writing by a professional transcriptionist and, using

a manual process, analyzed for codes, categories, and themes by 2 of the investigators who had prior experience with developing themes and codes from written transcripts and audio recordings.¹⁸ All qualitative data were integrated with the quantitative data in an effort to triangulate the final results of the study. The quantitative data collected were analyzed using descriptive statistics and are reported in aggregate format.

RESULTS

Of the 40 PharmD programs surveyed, responses were received from 28 (70%). The responding sample included 11 (39%) programs that required either 3 years of prerequisites (8 programs) or a bachelor's degree (3 programs) prior to admission and 17 (61%) that required 2 years of prerequisites. The responding sample was comprised of PharmD programs in 15 (54%) public colleges and schools and 13 (46%) in private institutions. This distribution compares well with that of public and private accredited or precandidate status PharmD programs in the United States. As of July 2012, 63 (49%) US PharmD programs were in public universities and 66 (51%) were in private institutions.¹⁹ The responding sample was also geographically diverse, representing all regions of the country (ie, 7 programs were located in the West, 4 in the Southwest, 3 in the Midwest, 8 in the South, and 6 in the Northeast). Both established and new (ie, ≤ 5 years) programs were represented (21 programs and 7 programs, respectively).

Nine (32%) programs participating in the online survey reported increasing their prerequisites over the past

5 years. Among the 19 programs reporting that they had not made a change in prerequisites, 6 (32%) had formally evaluated the need to increase their prerequisites. Twenty-six of the participating programs provided an estimate of the percentage of first-year pharmacy students admitted in 2011 who held a bachelor's degree; the average for all programs providing an estimate was 60%.

Compiled data from AACP on prerequisites¹¹⁻¹⁶ of ACPE-accredited PharmD programs indicated that in 2006, 4 programs required 3 years of prerequisites and no programs required a bachelor's degree; in 2011, these increased to 18 and 7 programs, respectively. As of 2011, among this cohort of 25 programs, 5 new programs were established after 2006 with increased prerequisite course requirements (ie, >2 years) at the time of their establishment: 2 programs that required 3 years of prerequisite courses and 3 programs that required a bachelor's degree were newly established after 2006. Eighteen (72%) of the 25 programs increased their prerequisites between 2006 and 2011. Two of the 25 programs required 3 years of prerequisites in 2006 and maintained the 3-year requirement through 2011. Figure 2 depicts the trends between 2006 and 2011, as confirmed by direct contact with a representative of each program.

Among 9 responding PharmD programs that recently increased their prerequisite courses, the primary rationale reported on the online survey instrument included the desire to raise the level of academic achievement of students entering the PharmD program ($n=7$ programs; 78%), the desire to increase incoming student maturity level ($n=4$, 44%), or the desire to add clinical science-based

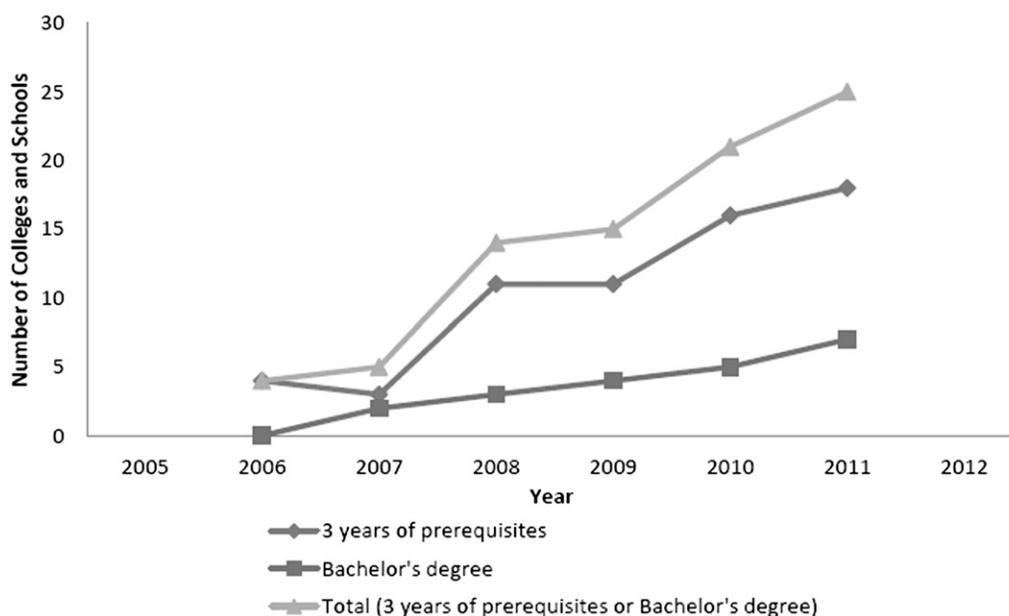


Figure 2. Trends in Prerequisites for Doctor of Pharmacy Programs, 2006-2011.

classroom or experiential coursework to the pharmacy curriculum, thus shifting selective basic science courses to the preprofessional program (n=4; 44%). Other rationales prompting an increase in prerequisites included influence of external constituents (eg, employers, accreditation, or state requirements) to increase prerequisites (n=2; 22%), consideration of the 2009 white paper on preprofessional curricula³ that recommended a minimum of 3 preprofessional years (n=1; 11%), the desire to remain competitive with other area or competitor schools (n=1; 11%); and the need to eliminate redundancy of material covered in prerequisite coursework and the first year (n=1, 11%).

Among 19 responding PharmD programs that had not increased their prerequisites in the past 5 years, the need to do so had recently been evaluated in 6 (32%) programs. The primary rationale prompting consideration of an increase in prerequisites in these programs was the desire to remain competitive with other area or competitor colleges and schools (n=2; 33%). Other rationales reported included desire to raise the level of academic achievement of students entering the program (n=1; 4%), desire to increase incoming student maturity level (n=1; 4%), desire to add clinical science-based classroom or experiential coursework to the pharmacy curriculum (n=1; 4%), consideration of the 2009 white paper on preprofessional curricula³ that recommended a minimum of 3 preprofessional years (n=1; 4%), and influence by external constituents (n=1; 4%).

The need to increase prerequisites had been recently evaluated in 3 PharmD programs, but in each case, the decision was made not to make changes. Reasons listed

for not extending the preprofessional program included concern over tangible costs for students, such as tuition for another year of school as well as salary foregone because of the additional prerequisite year; internal research at the school did not indicate that an increase was necessary; and the desire to decrease availability of professional program entry for community college students.

Qualitative data were collected from 9 PharmD programs by means of standardized telephone interviews to gather more in-depth information on rationales for increasing or not increasing prerequisite courses. Among the 3 categories of pharmacy programs, common themes of rationales (ie, those reported by representatives in more than 1 program) are shown in Table 1.

Among 9 responding PharmD programs that recently increased their prerequisite courses, the primary implications of doing so included a perceived improvement in the quality (ie, maturity, professionalism) of applicants (n=3; 33%), a temporary decrease in the number of applicants during the transition period (n=3; 33%), and a continued decrease in the number of applicants in the following years (n=2; 22%). One program's representative further elaborated that the number of applicants decreased in the first to second years following the new preprofessional requirements but normalized in subsequent years. The representative from another program reported that the number of applicants continued to decrease after preprofessional requirements were increased but that it was difficult to determine whether the decrease in applicants was solely related to the increased prerequisites or if competition for applicants was a contributing factor because of the increased number of pharmacy

Table 1. Common Themes of Rationales for Doctor of Pharmacy Programs Changing or Not Changing Admission Prerequisites

Program Category	Rationales
Programs requiring 2 years of prerequisites	Programs desired to remain competitive with other local schools. Outside constituents influenced the decision not to make a change (ie, students come from undergraduate pool). There was no compelling reason to change to a required bachelor's degree, or the school never considered a bachelor's degree requirement.
Programs requiring 3 years of prerequisites	Many students already complete 90 credits or a bachelor's degree upon admission. The change in prerequisites allowed additional clinical pharmacy content to the curriculum. Programs desired to remain consistent with local or nationally comparable colleges or schools. Moving to a required bachelor's degree was a competitive concern and was seen as too risky, or the program has never considered.
Programs requiring a bachelor's degree	Many students possess a bachelor's degree upon admission. Requiring a bachelor's degree raises the maturity level of students. A bachelor's degree ensures a broader educational foundation.

colleges and schools and saturation of local job markets. Another implication of increasing prerequisites included 1 report of an increase in the average composite Pharmacy College Admission Test score of the entering class. There were no reports of student financial aid complications related to the increase in prerequisites.

Common themes emerging from the standardized telephone interviews with selected PharmD programs were consistent with the online survey data. Among programs that required 3 years of prerequisite courses, the impact of increasing prerequisites varied somewhat but was mostly positive. Applicant pools at these colleges and schools were comprised of older, more mature students. At these institutions, either the increase in prerequisite courses did not negatively affect recruiting and applicant numbers, or if applicant numbers decreased, the decrease was thought to be related to the national trend of decreasing applicants rather than to the increase in prerequisites. Among programs that required a bachelor's degree, there was a negligible impact of increasing preprofessional requirements to include attainment of a bachelor's degree, considering that many programs reported high percentages of admitted students already having the degree prior to the change in requirements.

DISCUSSION

The methodology used in this study was a combined quantitative-qualitative data collection strategy that led to a stronger overall study compared with using either method alone.^{10,18} There were numerous advantages to using this mixed-methods approach, including: (1) imparting strengths that offset the weaknesses of both quantitative and qualitative research; (2) providing more comprehensive evidence; (3) addressing questions that could not be answered by either a quantitative or qualitative approach alone; (4) encouraging collaboration between quantitative and qualitative researchers; (5) encouraging use of multiple paradigms; and (6) allowing for multiple data collection methods. While our quantitative survey instrument did not include all US PharmD programs, and as such, may not have captured programmatic peculiarities, such as accelerated, track-specific, or block-curriculum programs, the high response rate (70%) coupled with random sampling of the control group can be considered strengths of this survey.

The responding sample was geographically diverse, was comprised of new and established PharmD programs, and represented both public and private schools. Limitations of this study include a relatively small overall quantitative sampling of US PharmD programs, as well as the small qualitative data sampling, although the latter metric is inherently restricted by the relatively low number of

schools having recently changed from the 2-year preprofessional requirement. As with any retrospective data collection, additional PharmD programs may have increased prerequisites since the most recent annual AACP collection of prerequisite data. To improve the validity of the trend analysis, we confirmed the preprofessional requirements for PharmD programs identified as requiring 3 years of prerequisites or a bachelor's degree for admission by directly communicating with representatives of the college or school or consulting its Web site.

Despite the noted limitations, the results herein clearly demonstrate that over the last 5 years, a significant increase has occurred in the number of established PharmD programs (programs that have been in existence >5 years) that have moved toward requiring either 3 years of prerequisite coursework or a bachelor's degree for admission to PharmD programs. Also between 2006 and 2011, as the number of PharmD programs has increased in the United States, several of these new programs were established with the preprofessional requirement of 3 years of prerequisites or a bachelor's degree.

Our data revealed several common rationales that programs have used to either support or refute the change from the traditional 2-year prerequisite paradigm. For example, representatives from programs that have recently moved to the bachelor's degree requirement universally stated that the conversion was a natural evolution, given that the overwhelming majority of applicants had already earned a bachelor's degree, which would make admission unlikely for the small number of applicants without degrees. The increasing number of applicants with bachelor's degrees was also a consideration for programs that recently changed to a 3-year preprofessional requirement. These programs reported that foundational basic science material required in the first year of the PharmD program was being repeated by many students who had previously taken these courses as part of their bachelor's degree. This redundancy was cited as a rationale for changing to the 3-year requirement, which allowed for curricular revision, providing more flexibility within the PharmD curriculum. Interestingly, in programs wherein a change to preprofessional requirements had been considered but the decision was made to remain with the 2-year model, competitive or financial issues were cited as the reason for not increasing the prerequisites. This concern may be consistent with the decrease in applicant pools reported for programs that have moved away from the "2+4 model."

Nonetheless, results of this study seem consistent with the movement of PharmD curricula from the fundamental toward the extended model, as described in a white paper,³ which includes addition of higher-level science

courses to preprofessional requirements. This shift was apparent in the sample of programs participating in our survey that required 3-year and bachelor's degree. Although variability exists in preprofessional course requirements among US PharmD programs, biochemistry, immunology, and genetics were frequently listed as prerequisite courses in programs requiring 3 years of coursework or a bachelor's degree for admission. Further, according to the white paper, completion of a bachelor's degree was thought to enhance a student's general abilities as well as increase maturity, and addition of upper-level science courses was noted to further supplement student abilities.³ Correspondingly, our study revealed that 1 of the perceived primary implications reported for programs that moved to either 3-year or bachelor's degree requirements was the recruitment of more mature and professional students.

The majority of pharmacy program deans strongly support a prescriptive preprofessional foundation in the basic sciences, and many also support requiring advanced basic science and math courses (eg, biochemistry, physiology, calculus, and statistics) for admission.⁹ Although research has found no agreement among deans on the ideal length of preprofessional studies, programs that require 2 years of prerequisites are inherently obligated to include foundational material within the professional curriculum, constraining their ability to offer advanced curricular opportunities.²⁰ On the contrary, an issue facing programs moving to "3+4" or "4+4" models is the decrease of basic science material within the professional curriculum, which can be considered an area of concern for the science-based pharmacy profession. Our findings from programs that raised their preprofessional requirements and, as a consequence, revised their professional curricula are consistent with this notion. However, the trend toward greater preprofessional requirements revealed by our study seems to contradict the AACP Argus Commission, which, in its 2011-2012 report, recommends that, "specification of pre-pharmacy prerequisites be minimized in favor of the use of better assessment tools and that preference in admissions be given to prepharmacy experiences that develop an inquisitive mind in our entering students."²¹ Likewise, ACPE accreditation standards and guidelines suggest that admission criteria, policies, and procedures consider qualities such as intellectual curiosity, emotional maturity, motivation, and communication skills, which support the student's potential to become a self-directed lifelong learner and an effective professional.¹

Caution should be exercised in concluding, based solely on this study, that the best practice is to require 3 years of coursework or a bachelor's degree. Our aims

were to look at trends and examine rationales and perceived implications for increasing prerequisites among a sample of US pharmacy programs. We made no comparisons among programs requiring 2 or 3 years of coursework or a bachelor's degree in terms of hard outcomes (eg, academic success in the first year, pass rates on board examinations, or level of achievement of ability outcomes between students who completed 2, 3 or 4 years of prerequisites) that could help define the best practice for preprofessional curricula.

Our data, along with the suggestions of Boyce and Lawson and the latest recommendations of the Argus Commission, suggest that further discussion and efforts are required within the academy to identify optimal preprofessional competencies and timeframes that will best enhance student abilities in order to drive educational and practice-based success.

CONCLUSIONS

The number of US PharmD programs that require either 3 years of prerequisite courses or a bachelor's degree for admittance into the pharmacy program has increased by 525% in recent years, from 4 schools in 2006 to 25 schools in 2011. The most common rationales stated for increasing preprofessional requirements included raising academic achievement, increasing student maturity, and adding clinical science-based classroom and experiential coursework to the PharmD curriculum. The implications and impact of increasing prerequisites were variable and included a perceived increase in maturity and quality of applicants and, for at least some schools, a temporary decrease in the number of applicants.

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