RESEARCH ARTICLES

Academic Pharmacy Administrators' Perceptions of Core Requirements for Entry Into Professional Pharmacy Programs

Kimberly Broedel-Zaugg, PhD,[a] Shauna M. Buring, PharmD,[b] Nathan Shankar, PhD,[c] Robert Soltis, PhD,[d] Mary K. Stamatakis, PharmD,[e] Kathy Zaiken, PharmD,[f] and J. Chris Bradberry, PharmD[g]

[a]Raabe College of Pharmacy, Ohio Northern University
[b]Winkle College of Pharmacy, University of Cincinnati
[c]College of Pharmacy, University of Oklahoma
[d]College of Pharmacy and Health Sciences, Drake University
[e]School of Pharmacy, West Virginia University
[f]Massachusetts College of Pharmacy and Health Sciences
[g]School of Pharmacy and Health Professions, Creighton University

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Objectives. To determine which basic and social science courses academic pharmacy administrators believe should be required for entry into the professional pharmacy program and what they believe should be the required length of preprofessional study.

Methods. An online survey was sent to deans of all colleges and schools of pharmacy in the United States. Survey respondents were asked to indicate their level of agreement as to whether the basic and social science courses listed in the survey instrument should be required for admission to the professional program. The survey instrument also included queries regarding the optimal length of preprofessional study, whether professional assessment testing should be part of admission requirements, and the respondents' demographic information.

Results. The majority of respondents strongly agreed that the fundamental coursework in the basic sciences (general biology, general chemistry, organic chemistry) and English composition should be required for entrance into the professional program. Most respondents also agreed that public speaking, ethics, and advanced basic science and math courses (physiology, biochemistry, calculus, statistics) should be completed prior to entering the professional program. The preprofessional requirements that respondents suggested were not necessary included many of the social science courses. Respondents were evenly divided over the ideal length for preprofessional pharmacy education programs.

Conclusions. Although requirements for preprofessional admission have been changing, there is no consistent agreement on the content or length of the preprofessional program.

Keywords: admission, prepharmacy curriculum, prerequisites

INTRODUCTION

The majority of colleges and schools of pharmacy in the United States require 2 years of preprofessional coursework; however, the number of colleges requiring 3 years of preprofessional coursework or a baccalaureate degree is increasing.[1] Changes in preprofessional requirements reported to the American Association of Colleges of Pharmacy over the past 5 years suggest that some programs have moved 1 or more of the biomedical or foundational courses to the preprofessional curriculum, perhaps due to an increase in the number of pharmacy courses in the professional curriculum. While all programs require a strong foundation in the math and sciences and specific courses in biology, general chemistry, organic chemistry, and calculus, there is less consistency with regard to required coursework in the social sciences, humanities, and biomedical sciences.[1] Thus, there is currently no clear consensus on preprofessional course requirements for entry into a doctor of pharmacy (PharmD) degree program. The purpose of this project was to evaluate academic pharmacy administrators' perceptions of core preprofessional requirements and the optimal length of study required for entry into the professional pharmacy curriculum.

The primary outcomes associated with the PharmD degree are to provide pharmaceutical care, manage and

Corresponding Author: Robert Soltis. Drake University, College of Pharmacy and Health Sciences, Des Moines, IA. E-mail: bob.soltis@DRAKE.EDU

use resources within the healthcare system, and promote health improvement and disease prevention, therefore, colleges of pharmacy must ensure that students entering pharmacy programs have the foundational knowledge and skills necessary to successfully complete the pharmacy curriculum. The Accreditation Council for Pharmacy Education (ACPE) standards (Standards 2007) stipulate adequate depth, scope, and emphasis of the biomedical sciences to provide the necessary foundation and support for the professional program.[2] ACPE does not mandate the specific courses or the quantity of coursework required to provide an adequate foundation in the basic and applied sciences.

Most colleges and schools require at least 2 years of preprofessional coursework as a foundation for professional pharmacy courses. With an expansion in pharmacy program outcomes pharmacy curricula have become increasingly crowded. As a result, many programs have shifted coursework that has traditionally been completed in the professional curriculum into the preprofessional curriculum. Thus, students may not be able to complete preprofessional studies in 2 years, causing some schools to require 3 or 4 years for completion of prerequisites.

Whether there is a correlation between a prior baccalaureate degree and success in the pharmacy program has been the subject of several studies. Investigators have evaluated the factors predicting academic success of pharmacy students and have found that a 4-year degree was positively correlated with grade point average (GPA) earned in the first year of the professional program.[3-5] However, other investigators found no significant correlation between completion of a bachelor of science (BS), bachelor of arts (BA), or master of science (MS) degree prior to entering pharmacy school and students' ability to complete the program and/or their North American Pharmacist Licensure Examination (NAPLEX) score.[6] Therefore, having a baccalaureate degree is a useful predictor of some but not all criteria for academic success.

Given that there is no clear consensus on length or content of preprofessional studies, the purpose of this research was to evaluate the importance of core preprofessional curriculum requirements as perceived by academic pharmacy administrators. Specific objectives of this study were to: (1) determine which basic and social science courses academic pharmacy administrators believe should be required for entry into the professional program, and (2) determine the minimum length of preprofessional study that should be required for admission into the professional program. Core preprofessional requirements were defined as courses that provide the foundation for the outcomes of the professional degree program and which are the preprofessional prerequisites in 2-, 3-, and 4-year PharmD programs or are typically taught in the first 2 years of 6-year PharmD programs. These requirements would form the basis of understanding for the pharmaceutical sciences; the social, behavioral, and administrative pharmacy sciences; and the clinical sciences.

METHODS

An e-mail requesting participation in an online survey was sent on February 12, 2007, to deans of the 102 colleges/schools of pharmacy in the United States as identified from the 2006-2007 American Association of Colleges of Pharmacy (AACP) Roster. A follow-up e-mail containing the survey instrument was sent 10 days later. Participation in the survey was voluntary and restricted to the dean or an appropriate administrative designee, and completion of the survey instrument implied informed consent. The web-based survey instrument was generated using SelectSurveyASP Advanced 8.1.1 (Atomic Design, LLC, Overland Park, KS) and consisted of 3 sections. In section 1, survey respondents were asked to indicate their level of agreement as to whether the courses listed should be required for admission to the professional program. The list consisted of 19 basic science courses and 14 social science courses and was generated from the preprofessional school prerequisites inventory generated by AACP. AACP course titles were used for the survey instrument and only courses listed by at least 6 colleges of pharmacy were included. Respondents were asked to indicate their level of agreement or disagreement using a 5-point scale on which strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. Section 2 of the survey instrument included queries regarding the optimal length of preprofessional study and whether the Pharmacy College Application Test (PCAT) or other professional assessment testing should be part of admission requirements. Section 3 requested demographic information including the respondent's academic/administrative title, length of career in academia and the type and geographical location (restricted to AACP districts) of the respondent's institution. (A copy of the survey instrument is available upon request from the lead author.)

Completed survey instruments were automatically routed to a designated folder on a secure server running the survey application. Responses received were free from any identifier tags and thereby remained anonymous and confidential. Responses were solicited up to 21 days from the time the survey instrument was initially made available to potential respondents. Data from the responses were analyzed using SPSS version 12.0. Alpha was set at 0.05.

RESULTS

Of the 102 e-mailed requests to participate in the survey, 57 were submitted for a response rate of 55.9%. The average respondent can best be described as a dean (57.9%) at a public institution (57.9%) with 25.4 years of academic experience including 10.5 years as dean. The most common curriculum (66.7%) consisted of 2 years of preprofessional study followed by 4 years of professional pharmacy education (2 × 4); 14.0% required 3 years of preprofessional study with 4 years of professional study (3 × 4); 8.8% admitted students directly out of high school into a 6-year program (0 × 6), and 7.0% required a bachelors degree for admission into a 4-year program (4 × 4). Two respondents did not respond to this item (Table 1).

Respondents agreed (3.4 ± 1.3) that the PCAT should be required for admission. They also agreed (3.5 ± 1.2) that professional assessment testing should be used as an admissions requirement. Eight respondents indicated that their institutions used a writing assignment, 4 used sample exercises, and 4 used group problem-solving exercises. Further, there was agreement (3.4 ± 1.0) that core preprofessional programs should be consistent as to content (Table 2).

Respondents agreed that general chemistry, organic chemistry, general biology, calculus, anatomy/physiology, and microbiology should be part of preprofessional pharmacy studies (Table 3). Analysis of variance was used to assess whether title of respondent, years at current institution, years in academics, type of curriculum, or geographic area had any influence on preprofessional studies. No significant differences occurred between any groups regarding preprofessional studies. Results for the social sciences indicated strong agreement for inclusion of only English composition and public speaking (Table 4). The Chi-square test was used to evaluate differences between private and public institutions. The survey instrument did not identify religious affiliation of private schools. Private schools (2.7 ± 1.2) were more likely to require a religion course(s) compared to public institutions (2.1 ± 1.0; $p = 0.048$). Further, public schools (3.7 ± 1.3) were more likely to favor the PCAT than private schools (3.0 ± 1.3; $p = 0.044$).

Respondents generally disagreed that pharmacy colleges should require a baccalaureate degree for admission (2.9 ± 1.5). However, the 4 respondents from colleges that required a baccalaureate degree strongly agreed (5.0 ± 0) that a prior degree was necessary. In regards to a 3 × 4 program, respondents agreed on this timeframe (3.2 ± 1.5). Further, the 8 respondents from colleges that currently offer a 3 × 4 program responded mostly positive (4.4 ± 1.4). Lastly, there was disagreement among respondents concerning the 2 × 4 timeframe (3.0 ± 1.4). Again, the 38 colleges currently offering the 2 × 4 were the most supportive (3.4 ± 1. 3).

Significant differences occurred between types of curricula that schools currently offer and respondents' opinions regarding the optimal time spent on preprofessional studies as well as professional pharmacy study. For example, those offering the 0 × 6 course of study strongly disagreed (1.8 ± 1.3) with those offering the 4 × 4 curriculum (5.0 ± 0.0) and those offering the 3 × 4 curriculum (4.3 ± 0.5) with respect to the requirement of a bachelor's degree for entry into the professional program ($p < 0.0001$). Respondents favored their own curricular time plan and disagreed across the board with others who offered a different preprofessional time plan.

Table 1. Demographics of US Academic Pharmacy Administrators' Responding to a Survey of Perceptions of Core Requirements for Entry Into Professional Pharmacy Programs (N=57)

Title, No. (%)		
Dean	33 (58)	
Associate/assistant dean	17 (30)	
Chair, curriculum committee	3 (5)	
Other	4 (7)	
Years at current institution	10.5 ± 9.5	Range: 0.25-32
Years in academics	25.3 ± 8.5	Range: 5-45
Type of curriculum, No. (%)		
0 - 6	5 (9)	
2 X 4	38 (67)	
3 X 4	7 (14)	
4 X 4	4 (7)	No response (2)
Public institution, No. (%)	33 (58)	
Private institution, No. (%)	22 (39)	No response (2)
AACP district, No. (%)		
1 (CT, ME, MA, NH, RI, VT)	2 (4)	
2 (DE, DC, MD, NJ, NY WV, PA)	12 (21)	
3 (AL, FL, GA, KY, MS, NC, SC, TN)	8 (14)	
4 (IL, IN, MI, OH, WI)	9 (16)	
5 (IA, MN, NE, ND, SD)	6 (11)	
6 (AR, KN, LA, MO, OK, TX)	8 (14)	
7 (AK, ID, MT, OR, WA, WY)	4 (7)	
8 (AZ, CA, CO, HI, NV, NM, UT)	6 (11)	No response (2)

Table 2. Level of Agreement or Disagreement Regarding Admission Requirements at US Colleges and Schools of Pharmacy (N= 57)

Item	Mean (SD)[a]
4-year baccalaureate degree	2.9 (1.5)
3 years of prepharmacy study	3.2 (1.5)
2 years of prepharmacy study	3.0 (1.4)
PCAT	3.4 (1.3)
Other professional test	3.5 (1.2)
Core programs should be consistent	3.4 (0.9)

Abbreviations: PCAT = Pharmacy College Application Test
[a]1= strongly disagree to 5 = strongly agree

DISCUSSION

Results of this study indicated that academic administrators agree that chemistry, organic chemistry, biology, calculus, anatomy and physiology, and microbiology should be included in the preprofessional requirements. There is a dearth of literature commenting on which courses should be included in the preprofessional coursework. There is some disparity between courses that respondents agreed should be in the preprofessional program and how often those courses were actually required for admission. For example, 63% of respondents agreed or strongly agreed that ethics should be a required course for entrance into the professional pharmacy program, but only 6% of schools required coursework in ethics.[1] Cell biology was a requirement in only 9% of programs, but 56% of respondents agreed or strongly agreed that it should be required. Another remarkable discrepancy was that 67% of respondents agreed or strongly agreed that biochemistry should be required for admission; however, only 8% of colleges mandated biochemistry for admission. The reason for the discrepancies between courses that respondents indicated should be required and those that were actually required in the preprofessional curriculum may have been a reflection of changing viewpoints not being implemented to current practices. That is, as the body of scientific knowledge expands and the practice and scope of the profession changes, pharmacy administrators realize the value of these courses to the professional curriculum but in reality are slow or unable to make these changes to the curriculum.

Table 3. US Academic Pharmacy Administrators' Preferences for Core Science Courses as a Preprofessional Requirement (N = 57)

Course Title	Mean[a]
General chemistry	4.8 (0.8)
Organic chemistry	4.8 (0.8)
General biology	4.7(0.9)
Calculus	4.4 (0.9)
Anatomy and physiology	4.3 (1.2)
Microbiology	4.0 (1.1)
Statistics	3.8 (1.2)
Biochemistry	3.8 (1.2)
Physics	3.7 (1.2)
Cellular biology	3.6 (1.2)
Molecular biology	3.4 (1.1)
Genetics	3.4 (1.0)
Immunology	3.3 (1.2)
Zoology	2.9 (1.3)
Bacteriology	2.7 (1.1)
Physical chemistry	2.4 (1.0)

[a]1 = strongly disagree to 5 = strongly agree

Table 4. US Academic Pharmacy Administrators' Preferences for Core Social Science Courses as a Preprofessional Requirement (N = 57)

Course Title	Mean
English composition	4.5 (1.0)
Public speaking	4.1 (1.0)
Ethics	3.8 (1.0)
English literature	3.5 (1.1)
Sociology	3.4 (1.1)
Business	3.3 (1.1)
Foreign language	3.1 (1.1)
Political science	3.0 (1.0)
Fine arts	3.0 (1.0)
Geography	2.6 (1.2)
Physical education	2.7 (1.3)
Music appreciation	2.4 (1.1)
Anthropology	2.4 (1.0)
Religion	2.3 (1.1)

[a]1 = strongly disagree to 5 = strongly agree

The purpose of the preprofessional curriculum is to prepare students for the professional pharmacy program. In this study, respondents agreed that the biomedical science courses microbiology, biochemistry, and cell biology were appropriate prerequisite courses for the professional pharmacy program. McCall et al found a correlation between completion of advanced biology courses beyond required foundational biology prerequisites and a higher mean grade point average (GPA) in the first professional year.[5] A more commonly debated course requirement for the preprofessional curriculum is physics. In this study, 56% of respondents agreed or strongly agreed that physics should be required, while 19% disagreed or strongly disagreed that physics should be a component of the preprofessional curriculum. In a survey performed by McCall in 2000, 77.6% of respondents indicated physics was a required course in the preprofessional curriculum.[7] An approximately equal number of

respondents indicated the course was either 1 semester or 2 semesters, but the total credit hours was highly variable, ranging from 3 semester credit hours to 10 semester credit hours. Based upon the most recent institutional data from AACP, 82.5% of pharmacy schools require physics for admission.[1] McCall argued the importance of physics in preparing students for the professional curriculum based on the relevance of concepts such as the mechanics of the human body, fluid dynamics related to blood pressure, thermodynamics of body temperature, and electrostatics related to action potential.[8]

In the current study, academic pharmacy administrators were evenly divided regarding whether a 4-year baccalaureate degree should be required for admission. Forty-one percent of the respondents agreed or strongly agreed with requiring a BS or a BA, while 43% disagreed or strongly disagreed. While they were similarly divided regarding their preference for a 2-year preprofessional curriculum, slightly more (51%) agreed or strongly agreed with requiring 3 years of preprofessional study than those who disagreed or strongly disagreed (35%). Several academicians have examined the impact of a prior BS degree on success in pharmacy school. Chisholm and colleagues found significantly more pharmacy students with a 4-year college degree progressed through the program without having a course grade of D or lower compared with non-degreed students.[9] In addition, the first-year GPA of pharmacy students with a prior 4-year college degree was significantly higher. McCall similarly found that students with a prior BS degree earned a higher first-professional year pharmacy GPA.[5] A 4-year college degree was also a good predictor of academic rank for first-professional year pharmacy students.[3] Renzi and colleagues recently addressed the issue of the impact of duration of preprofessional curricula on cumulative GPA in the professional program.[10] Students with a baccalaureate degree had a consistently higher GPA at the end of the first-professional year than students with 2 or 3 years of preprofessional prerequisites, or those who had been assured admittance through an early admittance process as freshmen. The impact of a baccalaureate degree on academic success was maintained through the second and third years of the professional program as those students with a degree had a higher GPA than those with only 2 years of preprofessional requirements.

Although earning a baccalaureate degree prior to admission may affect academic performance in the first-professional year, the impact on postgraduation performance has not been established. In 1 institution, a correlation between specific preprofessional variables and performance on the NAPLEX was evaluated.[6] Advanced coursework in biology, chemistry, and math was not significantly correlated with the score on the NAPLEX. Additionally, there was no correlation between the NAPLEX score and completion of a baccalaureate degree prior to admission.

In this study, respondents generally believed that the duration of the preprofessional program (ie, 2 years, 3 years, or baccalaureate degree) in place at their own institution was the most preferable. Discussions among pharmacy academicians have pointed to a 3- and 4-year preprofessional requirement not only for the beneficial coursework accomplished in those years, but also to prepare students with more maturity and focus, improved study skills, and prior upper-level courses to prepare them for the rigor of a professional program.[9] It is unclear whether the benefits of a baccalaureate degree are entirely related to the knowledge and general abilities gained or the result of other factors such as age, maturity, and time-management skills. DeLander articulated in a commentary that the academy has failed to critically evaluate what is required in applicants to pharmacy programs.[11] He purports that the current preprofessional requirements do not facilitate identification of applicants who have the intellectual strength to lead our profession. Additionally, in preprofessional programs that are 2 years in length, the curriculum is so constrained that courses that perhaps should be taught prior to the professional program are taught during the professional years, thereby limiting advanced educational opportunities. One can argue that students 2 years out of high school have limited emotional maturity and breadth of experience and are rushed to develop into caring, empathetic, well-educated health professionals. Several studies and published opinions support the extension of the preprofessional curriculum.[3-5, 9, 10] However, this should be carefully weighed against any potential risks assumed with extending the preprofessional program. The benefits assumed with extending preprofessional education are that students are better prepared, have more experiences to draw from, and are more mature – factors all purported to positively impact academic success in pharmacy school. However, there may be some risks inherent with increasing the amount of time in the preprofessional program and thus the time it takes to complete the entry-level PharmD degree program. For example, one could argue that lengthening the requirements and thus the duration of the preprofessional program impacts whether students choose to pursue a pharmacy degree or continue their education and training by completing a residency, fellowship, or entering a graduate program.

Concurrent to this study, the 2006-2007 AACP Academic Affairs Committee conducted an environmental scan of curricular changes that have occurred since the

Commission to Implement Change in Pharmaceutical Education in 1993. The Committee reported on preprofessional requirements and highlighted that while some schools have moved officially to a 3-year preprofessional requirement, many other schools have become "3-year preprofessional schools" in practice because the number and types of courses required are not possible to complete in a 2-year timeframe.[12] This group also questioned whether there is a need to establish a core preprofessional curricula or in fact a baccalaureate degree. The recommendation from the Academic Affairs Committee to AACP was to determine appropriate credentials and prerequisites for admission into the entry-level PharmD program and to explore the development of preprofessional competencies and a tool to assess preparation for admission. Based on the current study, it appears that there is not a clear consensus on this issue among academic pharmacy administrators. Any plan that attempts to standardize admission requirements into the professional pharmacy programs must take into account the diverse nature of the institutions that make up academic pharmacy.

CONCLUSION

The current requirements for entry into the professional pharmacy program are not standardized across US colleges and schools of pharmacy. The majority of academic administrators in pharmacy agree that the PCAT should be required for admission, and that basic science courses are essential building blocks for student learning. However, there is no consensus on the content or length of the preprofessional curriculum. Further evaluation of the optimal preprofessional courses and length is needed to determine the ideal preprofessional curriculum.

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