

## RESEARCH ARTICLES

### Attributes of Colleges and Schools of Pharmacy in the United States

David A. Knapp, PhD,<sup>a</sup> and Deanne E. Knapp, PhD<sup>b</sup>

<sup>a</sup>University of Maryland School of Pharmacy

<sup>b</sup>Rockville, Maryland

Submitted August 19, 2008; accepted September 28, 2008; published August 28, 2009.

**Objectives.** To compare the attributes of US colleges and schools of pharmacy and describe the extent of change to the pharmacy education enterprise associated with the addition of new schools.

**Methods.** Attributes analyzed included whether the college or school of pharmacy was old or new, public or private, secular or faith-based, and on or not on an academic health center (AHC) campus; had 3- or 4- year programs; and had PhD students enrolled. PharmD student enrollment-to-faculty ratios and junior-to-senior faculty ratios also were examined.

**Results.** Of the new colleges/schools, 76% were private and 79% were not located on a campus with an AHC; 6% had PhD enrollment compared with 80% of old colleges/schools. Faculty ratios were related to several college/school attributes, including the presence or absence of PhD students and whether the college/school was public or private.

**Conclusions.** Attributes of new colleges and schools of pharmacy have changed the overall profile of all colleges and schools of pharmacy. For example, smaller percentages of all colleges and schools of pharmacy are public and have PhD enrollees.

**Keywords:** pharmacy education, faculty-to-student ratio, college/school attributes

## INTRODUCTION

A proliferation of new colleges and schools of pharmacy has occurred in the United States since the mid-1990s. The intent of this paper is to describe several attributes of these new colleges and schools of pharmacy and compare them with the old. By so doing, we hope to stimulate data-based discussion on changes in the pharmacy education enterprise that are underway. To accomplish this, we integrated and summarized empirical information already publicly available but scattered. Much information was obtained from the American Association of Colleges of Pharmacy (AACCP) Web site,<sup>1</sup> with collateral information acquired from the pharmacy colleges'/schools' Web sites. Other Web sites utilized were Accreditation Council for Pharmacy Education (ACPE)<sup>2</sup> for their official actions through January 2008 and Association of Academic Health Centers for academic health centers' (AHC) locations as of May 2008.<sup>3</sup>

In the 1995-1996 academic year, 75 colleges and schools of pharmacy had enrolled students in first professional degree PharmD programs. For the purposes of our study, we designated these colleges/schools as "old."

Between fall 1996 and spring 2007, 14 additional colleges/schools established PharmD programs, graduated at least 1 class by spring 2007, and became fully accredited by the ACPE. We designated these colleges/schools as "new w/grads." An additional 12 colleges and schools of pharmacy had enrolled PharmD students by fall 2007 but had not graduated any PharmD students by spring 2007. We designated these colleges/schools "new/enr/no grads by S07." Another 8 colleges and schools were preparing to admit a first PharmD class in fall 2008 ("new/enr in F08"). Several more colleges/schools were in earlier stages of development. From 1996 to 2008, the number of functioning colleges and schools of pharmacy increased by 45% (from 75 to 109).

The total enrollment in the first professional degree PharmD programs of the "old" colleges/schools grew by over 30% from approximately 33,000 in fall 1996 to approximately 43,400 in fall 2007. A large part of this growth can be attributed to the transition from the 3-year to the 4-year professional program which took place for most "old" colleges/schools in the mid-to-late 1990s. The 14 "new w/grads" colleges/schools added an additional enrollment of 4,900 PharmD students, bringing the total PharmD enrollment in these 89 colleges/schools to 48,300, an increase of over 46% during the 11-year period.

This growth dwarfs that of other health professions. For example, while the Association of American Medical

---

**Corresponding Author:** David A. Knapp, PhD, University of Maryland School of Pharmacy, Shady Grove Campus, 9640 Gudelsky Drive, Rockville, MD, 20850-3480. Tel: 301-738-6371. Fax: 301-738-6040. E-mail: dknapp@rx.umaryland.edu

Colleges has recommended an increase in US medical college/school enrollment of 30% by 2015, based upon first-year enrollment in 2002, the number of medical colleges/schools has remained at about 126 since 1980. In 2007, 7 new allopathic medical colleges/schools were in development. Osteopathic medicine has opened 10 new colleges/schools since 1981.<sup>4</sup> The number of dental colleges/schools has declined since 1985 and even with the recent addition of new colleges/schools has not returned to that level.<sup>5</sup>

The large increases in the number of colleges and schools of pharmacy and in PharmD enrollment raise important issues linked to pharmacy workforce needs, the ability of colleges/schools to recruit and retain the quantity and quality of faculty members needed to deliver PharmD programs with larger enrollments, the change in the nature of pharmacy education, and the impact of the changing attributes of colleges and schools of pharmacy. The primary driver of increases in PharmD program enrollment and the initiation of new colleges and schools of pharmacy has been the shortage of pharmacy practitioners. Numerous studies over the past 10 years have explored the shortage and related it to the growing sales of prescription medications; increased third-party coverage for prescription drugs; aging of the baby-boomer generation, which has increased the number of elderly patients who use more pharmaceuticals; and the retirement of a large cohort of pharmacy practitioners.<sup>6</sup> A conference exploring professionally-determined need for 2020 forecasted a shortfall of some 150,000 pharmacists.<sup>7</sup>

While the pharmacist shortage may precipitate the founding of a new college or school of pharmacy, other factors also contribute to the decision, such as the desire to fulfill an institutional mission, the needs of related campus educational programs, the aspiration of the parent institution to expand its offerings (especially revenue-generating programs), and/or the availability of substantial additional resources and external support. Rapid growth of colleges and schools of pharmacy may overwhelm their ability to arrange adequate experiential sites and appoint qualified faculty members.<sup>8,9</sup> A shortage of faculty members, especially in the practice arena, is a major concern to the AACCP<sup>10</sup> and the American Foundation for Pharmaceutical Education (AFPE).<sup>11,12</sup> Since colleges and schools of pharmacy vary in the size of their PharmD programs, making comparisons based upon the absolute number of full-time (FT) faculty members would be misleading. However, the PharmD student-to-faculty member ratio is commonly used to provide some guidance to prospective students seeking information about colleges and schools of pharmacy. For example, the AACCP provided advice to prospective pharmacy students

to "...inquire about the following issues: ...The number of faculty members...and student-to-faculty ratios."<sup>13</sup> Therefore, PharmD student enrollment-to-FT faculty member ratios are of consequence.

The Commission to Implement Change in Pharmaceutical Education proposed that while individual colleges and schools of pharmacy have distinctive missions and that these missions may differ, the pharmacy education enterprise as a whole also has a mission. The Commission defined that mission as responsibility not only for educating future pharmacists (the PharmD program) but also for "...generating and disseminating new knowledge about drugs and about pharmaceutical care systems."<sup>14</sup>

The Commission also emphasized the responsibility of the enterprise for fostering research and scholarship, graduate studies, postgraduate clinical residencies and fellowships, and the continual evaluation of the nature and scope of its activities. While the Commission noted that it does not expect all colleges/schools to do all of these things, all should endorse them as part of the mission of the enterprise. The incremental attributes of each new college/school change the configuration or profile of the entire pharmacy education enterprise and in so doing influence how it might meet its mission and broad responsibilities.

We looked at 3 different aspects of the pharmacy education enterprise: (1) attributes of the 109 functioning colleges and schools of pharmacy as of 2008, (2) attributes of the 89 colleges and schools of pharmacy with PharmD graduates as of 2007, and (3) the attributes of these 89 colleges/schools linked to faculty member characteristics and ratios.

## **METHODS**

Six attributes were used in the analyses of US colleges and schools of pharmacy. Three attributes were permanent characteristics of the college/school or its institution and unlikely to change: public/private status, secular/faith-based, and location on a campus with/without an AHC. Two attributes were under the control of the pharmacy college/school and might change over time: PharmD program length and PhD offerings. The sixth attribute, "old" or "new" pharmacy college/school, was defined previously. These attributes were summarized for all 109 colleges/schools.

In order to examine college/school attributes in relation to PharmD enrollment and faculty member characteristics, only the 75 "old" colleges/schools and 14 "new w/grads" colleges/schools were included in subsequent analyses. These 89 colleges/schools offered all the US fully-accredited PharmD programs that conferred entry-level PharmD degrees in spring 2007. The attributes of

these 89 schools were crosstabbed to provide a more detailed description.

For the 89 colleges/schools, PharmD student enrollment-to-FT faculty ratios were computed. Only FT faculty members listed in the AACP *Roster of Faculty and Professional Staff, 2007-2008*<sup>15</sup> with both an academic discipline and an academic rank of instructor, assistant professor, associate professor, or professor were included. Chief executive officer deans were excluded, regardless of academic rank. Also excluded were faculty members listed as adjunct, temporary, part-time, emeritus, or lecturer.

Faculty members were grouped as either “practice faculty members” or “nonpractice faculty members.” Practice faculty members accounted for about half of all FT appointments; most held a PharmD degree. Nonpractice faculty members include all other FT faculty members; most held a PhD degree.<sup>16</sup>

The following ratios were calculated for each of the 89 colleges/schools: (1) number of fall 2007 PharmD students to number of practice faculty members, and (2) number of fall 2007 PharmD students to number of nonpractice faculty members. The lower the ratio, the fewer number of PharmD students per faculty member.

Each of the 2 faculty groups was divided into junior and senior faculty members. Junior faculty members were defined as instructors or assistant professors; senior faculty members were defined as associate or full professors. The following ratios were calculated for each of the 89 colleges/schools to assess relative levels of FT faculty member seniority: (1) number of junior practice faculty members to number of senior practice faculty members and (2) number of junior nonpractice faculty members to number of senior nonpractice faculty members. A ratio lower than 1 meant there were more senior than junior faculty members, and a ratio higher than 1 meant more junior than senior faculty members.

## RESULTS

### Attribute Tabulations

Comparisons of attributes among the 109 colleges/schools (and their subgroups) are provided in Table 1. Figure 1 summarizes the data in Table 1 by percentages and shows noticeable differences between “old” and “new” colleges/schools for each attribute.

The 6 attributes for the 89 “old” and “new w/grads” colleges/schools are presented in Table 2. The majority of these colleges/schools were “old”, public, secular, not on the same campus with an AHC, had only 4-year PharmD programs, and/or had PhD enrollment.

After crosstabbing these 6 attributes, the following results are the highlights (complete data available from corresponding author). Eighty percent of “old” colleges/

schools had PhD enrollees compared to 7% of “new w/grads” colleges/schools; 28% of “old” colleges/schools were private compared to 86% of “new w/grads” colleges/schools; and 5% of “old” colleges/schools had 3-year programs compared to 36% of “new w/grads” colleges/schools.

Ninety-one percent of public colleges/schools had PhD enrollees compared to 30% of private colleges/schools; 55% of public colleges/schools were on a campus with an AHC compared to 15% of private colleges/schools; and 27% of private colleges/schools were faith-based.

None of the colleges/schools with 3-year programs was on a campus with an AHC compared to 45% of colleges/schools with only 4-year programs. Eleven percent of the colleges/schools with a 3-year PharmD program had PhD enrollees compared to 75% of colleges/schools with only a 4-year PharmD program.

Eight-nine percent of colleges/schools on a campus with an AHC had PhD enrollees compared to 55% of colleges/schools not on such a campus. Seventy-three percent of secular colleges/schools had PhD enrollees compared to 33% of faith-based colleges/schools.

### Faculty Ratios

Results are given as medians. Overall, both the PharmD student-to-practice faculty ratio and the PharmD student-to-nonpractice faculty ratio were 23. Overall, the junior-to-senior faculty ratio for practice faculty was 1.2 compared to the 0.4 for the nonpractice faculty.

Comparing these ratios on the “old” versus “new w/grads” attribute, some differences emerged. Although PharmD student-to-practice faculty ratios were similar, the PharmD student-to-nonpractice faculty ratios were lower at “old” (22) compared to “new w/grads” (39). “Old” colleges/schools have both a lower junior-to-senior practice faculty ratio (1.1) and junior-to-senior nonpractice faculty ratio (0.4) compared to “new w/grads” colleges/schools (3.5 for practice faculty and 0.9 for nonpractice faculty).

Since almost 70% of colleges and schools had PhD enrollees, this further analysis affirmed the confounding effect of this attribute on ratios. Therefore, subsequent comparisons were made on either “no PhD enrollees” or “PhD enrollees,” based on whichever comparison maximized the “N” for the comparison.

After crosstabbing college/school attributes with the 4 faculty ratios, the following highlights were noted. For colleges/schools with no PhD enrollees, the “old” colleges/schools (N = 15) had a noticeably lower junior-to-senior practice faculty ratio of 1.4 compared to the “new w/grads” colleges/schools (N = 13) which had a ratio of 4.3. The “old” colleges/schools had a junior-to-senior

Table 1. Attributes of Colleges and Schools of Pharmacy in the United States (N = 109)

| Attributes                     | Colleges/Schools of Pharmacy by Type of Program, No. |                          |                                      |                             |                      |                                   |
|--------------------------------|--|--------------------------|--------------------------------------|-----------------------------|----------------------|-----------------------------------|
|                                | Old <sup>a</sup>                                     | New w/Grads <sup>b</sup> | New/Enr/No Grads by S07 <sup>c</sup> | New/Enr in F08 <sup>d</sup> | All New <sup>e</sup> | All Colleges/Schools <sup>f</sup> |
| Colleges/Schools               | 75   | 14                       | 12                                   | 8                           | 34                   | 109                               |
| Public                         | 54   | 2                        | 5                                    | 1                           | 8                    | 62                                |
| Private                        | 21   | 12                       | 7                                    | 7                           | 26                   | 47                                |
| Secular                        | 68   | 12                       | 9                                    | 3                           | 24                   | 92                                |
| Faith-based                    | 7  | 2                        | 3                                    | 5                           | 10                   | 17                                |
| AHC-Yes                        | 32   | 4                        | 2                                    | 1                           | 7                    | 39                                |
| AHC-No                         | 43   | 10                       | 10                                   | 7                           | 27                   | 70                                |
| 3yr PharmD                     | 4  | 5                        | 2                                    | 1                           | 8                    | 12                                |
| 4yr-only PharmD                | 71   | 9                        | 10                                   | 7                           | 26                   | 97                                |
| PhD Enrollees-Yes <sup>g</sup> | 60   | 1                        | 1                                    | 0                           | 2                    | 62                                |
| PhD Enrollees-No               | 15   | 13                       | 11                                   | 8                           | 32                   | 47                                |

Abbreviations: AHC = academic health center

<sup>a</sup> Colleges/schools with entry-level PharmD students before fall 1996

<sup>b</sup> Colleges/schools with entry-level PharmD students enrolled during/after fall 1996 and at least 1 graduating class by spring 2007

<sup>c</sup> Colleges/schools with PharmD students but no graduating class by spring 2007; South Carolina College of Pharmacy was omitted because its merger of 2 old colleges had not been completed

<sup>d</sup> Colleges/schools scheduled to enroll PharmD students in fall 2008

<sup>e</sup> Sum of New college/school groups

<sup>f</sup> Sum of All college/school groups

<sup>g</sup> At least 1 PhD student enrolled in fall 2007

nonpractice faculty ratio of 0.6 compared to the “new w/ grads” colleges/schools which had a ratio of 1.0.

For colleges/schools with no PhD enrollees, the secular colleges/schools (N = 22) had a PharmD student-to-practice faculty ratio of 28 compared to the faith-based colleges/schools (N = 6) which had a ratio of 18. The

secular colleges/schools had a junior-to-senior practice faculty ratio of 2.5 compared to the faith-based colleges/schools ratio of 1.2. For nonpractice faculty, this relationship was reversed with the secular colleges/schools having a junior-to-senior faculty ratio of 0.7 as compared to the faith-based colleges/schools ratio of 1.2.

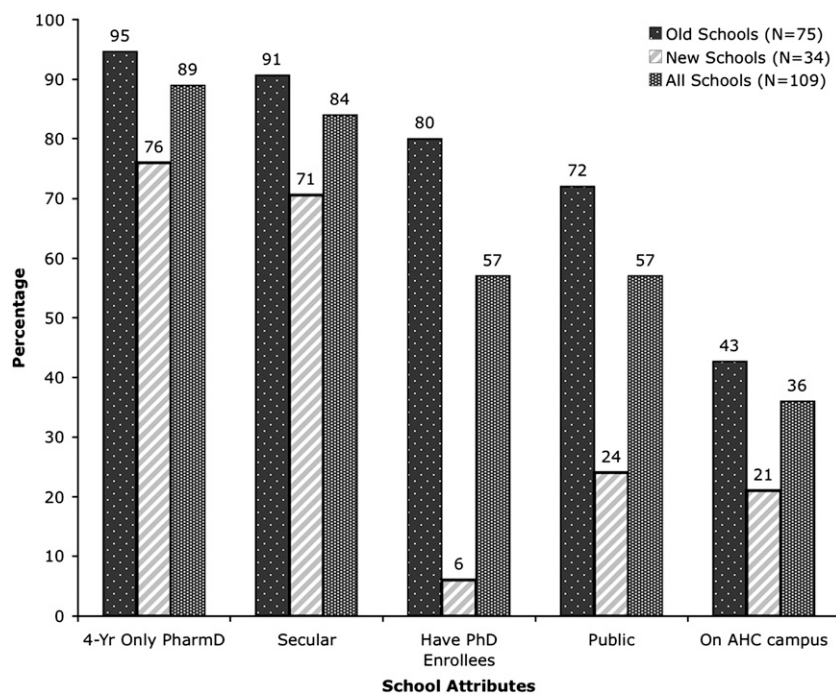


Figure 1. Attributes of US Colleges and schools of pharmacy, 2008.

Table 2. Attributes of “Old” and “New w/Grads” Colleges and Schools of Pharmacy (N=89)

| Attribute         | No. (%) |
|-------------------|---------|
| Old               | 75 (84) |
| New w/Grads       | 14 (16) |
| Public            | 56 (63) |
| Private           | 33 (37) |
| Secular           | 80 (90) |
| Faith-based       | 9 (10)  |
| AHC-yes           | 36 (40) |
| AHC-no            | 53 (60) |
| 3yr PharmD        | 9 (10)  |
| 4yr-only PharmD   | 80 (90) |
| PhD enrollees-yes | 61 (69) |
| PhD enrollees-no  | 28 (31) |

For colleges/schools with no PhD enrollees, ratios for the 3-year program colleges/schools (N = 8) were similar to the ratios for the colleges/schools with only a 4-year PharmD program (N = 20). For colleges and schools with PhD enrollees, the public colleges/schools (N = 51) had a PharmD student-to-practice faculty ratio of 19 compared to the private colleges/schools (N = 10), which had a ratio of 38. The public colleges/schools had a PharmD student-to-nonpractice faculty ratio of 19 compared to the private colleges/schools which had a ratio of 45. Both public college/school ratios were noticeably lower than those for private colleges/schools.

For colleges/schools with PhD enrollees that also had an AHC on campus (N = 32), the PharmD student-to-practice faculty ratio was 18 compared to colleges/schools without an AHC on campus (N = 29, ratio of 25). Colleges/schools on a campus with an AHC had a PharmD student-to-nonpractice faculty ratio of 18 compared to colleges/schools not on a campus with an AHC (ratio of 23). Thus, both types of ratios are lower on campuses with an AHC.

## DISCUSSION

To develop a framework for efficiently monitoring changes in the pharmacy education enterprise without collecting new data via surveys, this study focused on identifying pharmacy college/school attributes that easily could be measured. We used information publicly available on the AACP Web site and its printed reports as our primary sources. These data had been collected routinely through several survey instruments, and response rates from the colleges/schools had approached 100%. However, reliance on these AACP surveys has limitations: (1) college/school data were self-reported, (2) information on college/school involvement in residency, post-PharmD fellowship, and post-PhD training programs had not been

collected routinely, (3) data on computer-mediated distance education had not been collected, and (4) the terms, *satellite* and *branch campuses* and *part-time faculty members*, were not defined consistently and/or precisely.

Our study’s most notable finding was the difference in attributes between “old” colleges and schools of pharmacy that were predominantly public and had PhD enrollees and “new” colleges/schools that were predominantly private with almost none having PhD enrollees.

While it is reasonable to expect “old” colleges/schools would have more senior than junior faculty members compared to “new w/grads” colleges/schools, the latter’s much higher PharmD student-to-nonpractice faculty ratio is notable. The most likely attribute to influence this would be the presence or absence of PhD enrollment (see Figure 1). The existence of a PhD program probably would require more FT nonpractice faculty members not only for the graduate teaching needed but also because of the likelihood of concomitant research responsibilities. Thus, the overall PharmD student-to-nonpractice faculty ratio is likely to be spuriously low. When the ratios for colleges/schools with and without PhD enrollees were calculated, this was found to be the case. For colleges/schools with PhD enrollees, the resultant ratio (21) was similar to the overall ratio (23). However, for colleges/schools with no PhD enrollees, the results showed a higher PharmD student-to-nonpractice faculty ratio (39) compared to the overall ratio (23).

Other noteworthy findings concerned FT faculty ratios and were: (1) for colleges/schools with PhD enrollees, the much higher ratios for PharmD student-to-practice faculty and PharmD student-to-nonpractice faculty in private colleges/schools compared to public colleges/schools, and (2) for colleges/schools without PhD enrollees, the much higher ratio for junior-to-senior practice faculty for “new w/grads” colleges/schools compared to “old” colleges/schools.

Each of the relationships identified in this study may be interpreted in several different ways and reflect the interpreter’s biases; however, what is undeniable is that the pharmacy education enterprise has changed. Even if the study’s limitations were not present, the enterprise has yet to come to grips with: (1) the optimal mix of attributes across colleges/schools, (2) appropriate ratios of PharmD student-to-practice and nonpractice FT faculty members and FT junior-to-senior practice and nonpractice faculty members, (3) what constitutes a part-time (PT) faculty member and appropriate ratios of PT-to-FT faculty members, and (4) how faculty and student ratios could or should change with the use of new teaching technologies.

The latter 3 issues are often the subjects of discussion within individual colleges and schools of pharmacy and at

educational meetings. Within limits, a college/school may resolve them internally. The value of these ratios as quality indicators awaits research linking them to process indicators, eg, curriculum design and teaching methods, and ultimately to student learning outcomes.

In the context of the entire pharmacy education enterprise, who is to determine, eg, the right number of private schools or the right mix of 3-year versus only 4-year programs? ACPE accreditation standards do not deal with the constellation of PharmD programs or other elements of the enterprise, eg, residency programs and graduate education, and only tangentially with research and scholarship. AACP would be a logical choice to address these issues but may be constrained in taking actions favoring any segment of its institutional members. Will an unfettered educational marketplace result in the best solution for the healthcare workforce and the pharmacy profession? Or will Gresham's Law prevail, and the bad drive out the good? If so, who will define and influence what is bad and what is good?

## CONCLUSION

The PharmD student-to-faculty member ratios and junior-to-senior faculty member ratios are controllable by colleges and schools of pharmacy and can change over time. However, some of the attributes are institutional and thus not controllable by the colleges and schools of pharmacy. The pattern of attributes in the group of "new" colleges/schools differed substantially from the pattern of the "old" schools. This has resulted in a rapidly developing change in the configuration or profile of the pharmacy education enterprise as a whole.

While much needed attention has been paid to the evaluation of individual PharmD programs as they travel the path to full accreditation, not nearly enough attention has been focused on the global changes in the pharmacy educational enterprise. This study has provided a template and some initial data for assessment and use in future planning.

## ACKNOWLEDGEMENTS

The authors acknowledge with thanks the following individuals who commented on a draft of this paper: Jordan L. Cohen, PhD, Daniel A. Hussar, PhD, Mary Anne Koda-Kimble, PharmD, Donald E. Letendre, PharmD, Henri R. Manasse, Jr., PhD, Richard P. Penna, PharmD, and William H. Riffée, PhD.

## REFERENCES

1. American Association of Colleges of Pharmacy (AACP). Home page. Available at: <http://www.aacp.org> Accessed August 6, 2009.
2. Accreditation Council for Pharmacy Education (ACPE). Home page. Available at: <http://www.acpe-accredit.org> Accessed August 6, 2009.
3. AAHC Members. Association of Academic Health Centers website. Available at: <http://www.aahcdc.org/about/members.php> Accessed August 6, 2009.
4. Flood of new medical schools filling accreditation pipeline. American Medical Association. Available at: <http://www.ama-assn.org/amednews/2008/01/21/prsd0121.htm>. Accessed August 6, 2009.
5. Table 110. First-year enrollment and graduates of health professions schools, and number of schools, by selected profession: United States, selected years 1980-2005. In: National Center for Health Statistics, Health, United States, 2007, With Chartbook on Trends in the Health of Americans. Hyattsville, Md.: National Center for Health Statistics;2007:360. Available at: <http://www.cdc.gov/nchs/data/abus/hus07.pdf> Accessed August 6, 2009.
6. Department of Health & Human Services. The Pharmacist Workforce: A Study of the Supply and Demand for Pharmacists. Rockville, Md.: Health Resources and Services Administration; 2000. Available at: <http://bhpr.hrsa.gov/healthworkforce/reports/pharmacist.htm> Accessed August 6, 2009.
7. Knapp DA. Professionally determined need for pharmacy services in 2020. *Am J Pharm Educ.* 2002;66(4):421-9.
8. Hussar DA. How many colleges of pharmacy is enough? *J Am Pharm Assoc.* 2005;45(4):428-30.
9. Draugalis JR, DiPiro JT, Zeolla MZ, Schwinghammer TL. A career in academic pharmacy: opportunities, challenges and rewards. *Am J Pharm Educ.* 2006;70(1):Article 17.
10. Beardsley R, Matzke GR, Rospond R, et al. Factors influencing the pharmacy faculty workforce. *Am J Pharm Educ.* 2008;72(2): Article 34.
11. American Foundation for Pharmaceutical Education (AFPE) news release: AFPE awards \$750,000 to pharmacy students and pharmacy faculty at 47 schools in campaign to solve pharmaceutical scientist shortage, December 6, 2007. Available at: <http://www.afpenet.org/news.htm>. Accessed August 6, 2009.
12. American Foundation for Pharmaceutical Education (AFPE) news release: Acute shortage of faculty at U.S. pharmacy schools threatens efforts to solve nation's pharmacist shortage, July 29, 2003. Available at: [http://afpenet.org/news\\_acute\\_shortage.htm](http://afpenet.org/news_acute_shortage.htm). Accessed August 6, 2009.
13. *Pharmacy School Admission Requirements, 2008-2009.* Alexandria, Va.:American Association of Colleges of Pharmacy, 2007:xvi.
14. Commission to Implement Change in Pharmaceutical Education. Papers from the Commission to Implement Change in Pharmaceutical Education. *Am J Pharm Educ.* 1993;57(4):376.
15. *Roster of Faculty and Professional Staff: 2007-2008,* Alexandria, Va.:American Association of Colleges of Pharmacy, 2007.
16. Full-time pharmacy practice and pharmaceutical sciences faculty 1986-2007. *Academic Pharmacy Now.* May/June 2008;54.