

RESEARCH ARTICLES

Projected Growth in Pharmacy Education and Research, 2010 to 2015

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Submitted December 6, 2010; accepted April 18, 2011; published August 10, 2011.

Objectives. To determine projected growth in pharmacy education and research from 2010 to 2015 and to relate findings to external and internal factors.

Methods. An e-mail survey instrument was sent to all US pharmacy deans, and responses were used to estimate growth in the number of first-professional-degree doctor of pharmacy (PharmD) graduates, residents/fellows, graduate students, faculty members, graduate research faculty members, and post-doctoral fellows. Results were related to the national economy, trends in faculty vacancies, growth trends in other health professions, pharmacist roles, and healthcare reform.

Results. Five-year growth projections were: 58% increase in the number of residents/fellows, 23% in postdoctoral fellows, 21% in entry-level PharmD graduates, 19% in graduate/research faculty members, 17% in graduate students, and 13% in total pharmacy faculty members. Residencies/fellowships showed the highest projected growth rates (58%). Graduate education and research data suggest a growing research enterprise. Faculty vacancy trends were downward and this suggests better faculty availability in coming years.

Conclusions. Substantial growth is expected from 2010 to 2015 in all areas of pharmacy education. External factors and how well the profession is able to demonstrate its contribution to resolving healthcare problems may influence the actual growth rates achieved.

Keywords: pharmacy education, pharmacy faculty members, residents, fellows, graduate students, growth, research

INTRODUCTION

Increases in the number of pharmacy colleges and schools, class size, and new campuses for established pharmacy programs raise questions about finding a sufficient number of qualified faculty members and retaining a reasonable balance between the supply of and demand for pharmacists. Retrospective data have been used to address these issues.^{1,2} However, the educational landscape, national economy, and healthcare reform, all of which are factors that potentially influence the balance between pharmacist supply and demand, continue to change, thereby calling into question any conclusions based on past trends. To gain a prospective insight on these issues, we undertook a study to address the growth of pharmacy education, training, and research enterprises between 2010 and 2015.

Relative to growth in education, the expansion of PharmD training programs, campuses, and class size has received much attention.²⁻⁴ Assessment of other aspects of pharmacy educational growth, for example, the availability of a sufficient number of qualified faculty members, requires information about the projected growth of residency, fellowship, and graduate programs. Growth of the research enterprise within colleges and schools of pharmacy requires prospective plans for adding graduate students, pharmacy and postdoctoral fellows, and faculty members who are able to support graduate education and research. This study estimated future growth in these areas through 2015.

Some work has been done in defining the personnel needed to support growth in pharmacy education and research. A 2002 study estimated a need (not a forecast of demand) for 3,250 full-time equivalent (FTE) pharmacists in academia in 2020 compared with the 2,600 FTE positions existing in 2001.⁵ A 2008 report from an American Association of Colleges of Pharmacy (AACCP) Task

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Force projected the demand for pharmacy faculty members to increase by about 20% over the next 10 years.⁶ The same report also cited a 27% increase in the number of individuals participating in the American Society of Health-System Pharmacy (ASHP) residency-matching program between 2003 and 2005. A 2007 study reported that pharmacy faculty member shortages are related to the approaching retirement of those who began careers during the capitation period of the 1970s.⁷ The study also noted that efforts to resolve the retirement-related shortage are likely to be mixed because the number of individuals entering residency training is growing while the number of students pursuing graduate education is declining. With respect to residency training, a 2006 American College of Clinical Pharmacy (ACCP) position statement cites a 2003 ASHP and ACCP goal of 3,000 accredited residency positions by 2007 as compared with the approximately 1,700 positions available at that time.⁸ This interim goal was described as a step toward achieving the strategic vision that approximately 75% of the estimated 10,000 annual pharmacy graduates in 2020 would complete a first-year (PGY1) residency.⁸

A 2009 study reported that the demand and opportunities for clinical pharmaceutical scientists “have never been greater.”⁹ The opportunity for clinical research scientists was reported to be present not only in pharmacy education but also in the pharmaceutical industry. This same issue was addressed in a 2006 report noting that neither graduate education nor fellowship training was meeting the current or future needs for clinical pharmacy scientists.¹⁰ Finally, in 2009, proponents of pharmacy fellowships presented arguments to maintain and increase pharmacy fellowship training as a strategy—along with graduate education—to maximize clinical scientist training opportunities.¹¹ Recommendations and conclusions drawn in these research efforts preceded current economic conditions, which have reshaped supply and demand across the nation.

Growth issues in health education programs are not limited to pharmacy. The Center to Champion Nursing in America cites 2006 data from the Health Research and Services Administration that stated “the United States must graduate 90% more nurses from its nursing programs to meet the growing need.”¹² The US Secretary of Education’s Commission on the Future of Higher Education discussed the preparation of the health workforce in a 2006 issue paper.¹³ Schiff cited double-digit increased demand for services between 2004 and 2014 across dentistry, pharmacy, nursing, and medicine. In order to partially meet this expected demand, the Association of American Medical Colleges (AAMC) recommended that medical schools increase enrollment by 15% and consider 30% increases by

2015 to meet future physician needs. According to the paper, nursing must also expand capacity, but accomplishing this goal is complicated by a nursing faculty vacancy rate of 8.5% and an inadequate number of nursing students pursuing master’s or other graduate nursing degrees. A similar situation has emerged with dental faculty members who have a 10% annual turnover rate and are approaching retirement over the next 10 to 15 years (average retirement age is 52 years).

The growth in primary care health professionals is supported by workforce-expansion funding from the Affordable Care Act. The Web site HealthCare.gov reports a shortage of approximately 21,000 primary care physicians in 2015 and associated government funding to train, develop, and place more than 16,000 new primary care providers over the next 5 years.¹⁴ Funding is designated in part to train 500 new primary care physicians by 2015, 600 physician assistants, and 600 nurse practitioners. The AAMC has estimated an even larger physician shortage of 124,000 doctors by 2025.¹⁵ The Carnegie Foundation for the Advancement of Teaching released a 2010 medical education study that proposed 7 policy recommendations, 1 of which is a collaborative effort within medicine to develop a medical workforce policy for the United States.¹⁶ To date, broad-based consideration of a pharmacy workforce policy has not occurred; however, initiatives to increase the physician and nursing workforce must be considered when assessing whether expansion in pharmacy is likely to fill an unmet need for health professionals.

The purpose of this study was to estimate growth across pharmacy education and research enterprises from 2010 to 2015 and to integrate the resulting data with that from other sources to inform planning and decision-making regarding pharmacy education, training, and research.

METHODS

A 10-question prospective survey instrument focusing on growth in pharmacy education, training, and research was developed and tested for face validity by a 6-person pharmacy faculty team from public and private and new and mature PharmD programs serving on an AACP Taskforce. The survey items requested baseline data for 2010 and growth projections for 2012 and 2015. Growth in the following areas was investigated: the number of FTE faculty members on the current campus, FTE faculty members on a new or branch campus, entry-level PharmD graduates, pharmacy residents and fellows, graduate students, postdoctoral (post-PhD) fellows, and graduate faculty members. A copy of the survey instrument is available from the authors. The project was submitted to

the Touro University California IRB Committee and determined to be exempt.

The e-survey (SurveyMonkey, Palo Alto, CA) was sent to pharmacy deans through the AACP CEO Deans' Listserv on May 10, 2010. A reminder e-mail was sent to the same listserv on June 3, 2010. The survey was closed June 29, 2010. Descriptive data analysis was accomplished in Microsoft Excel. The initial dataset was analyzed to eliminate duplicate records and responses from non-US programs. These data were used to project nationwide growth in pharmacy education and research.

Data regarding faculty vacancies in 2007, 2008, and 2009 were obtained from annual AACP Faculty Vacancy Surveys (Danielle Taylor, AACP, written communication, September 11, 2010).

RESULTS

At the close of the survey (June 30, 2010), 85 responses had been received. The AACP CEO Deans' Listserv at that time included 116 schools, exclusive of programs outside the United States. Four non-US responses were excluded from the survey data and duplicate records for 4 colleges and schools that submitted data twice were eliminated. The final number of records analyzed was 77, for a response rate of 66.4%. Six records listed over 300 entry-level PharmD graduates for 2010, 2012, and 2015 (range, 340-650). These responses likely reflected total enrollment rather than graduates, as 2010 AACP data showed no school with over 300 graduates. These 6 graduate estimates were not included in growth analysis for entry-level PharmDs.

Based on a formula for small samples,¹⁷ a target response rate for a population of 116 is 77%. This study's 66.4% response rate exceeded "very good" for an e-mail survey.¹⁸ The measures comparing characteristics of respondents and all US schools are shown in Table 1. Average 2010 entry-level PharmD graduating class sizes were almost identical between respondents and all colleges and schools. Respondent graduate programs enrolled 9.8% fewer students on average compared with all US pharmacy graduate programs.

Respondents' geographic distribution was similar to that of all schools with almost identical percentages of respondents located in the Midwest and South, 3.7% more in the Northeast, and 5.6% less in the West. The percentage of new colleges and schools identified as having no graduates in 2010 was similar between respondents and all institutions, with a slightly lower representation of new colleges and schools in the respondent group.

Table 2 shows a summary of the responses related to first-professional degree PharmD graduates. These graduates are expected to increase 21% from 2010 to 2015 with 13,856 projected graduates in 2015, based on extrapolation

Table 1. Characteristics of Respondents and All Schools

Characteristic	Respondents, n=77	All Pharmacy Schools, N=116
Mean 2010 Entry-Level PharmD Graduates, No. (SD)	98.8 (59.3)	99.7 (66.0)
Mean 2010 Graduate Students Enrolled, No., (SD)	53.5 (46.8)	59.3 (47.5)
Geographical Region (%)		
Northeast	18.1	14.4
Midwest	24.7	23.4
South	40.2	40.5
West	16.0	21.6
New Schools ^a , %	10.4	12.9

^a A school with no graduates in 2010 was defined as "new."

from respondent data. Thirty-seven schools reported no plans for PharmD growth over the 5-year period.

The number of FTE faculty members is expected to increase 13% from 4,973 in 2010 to 5,719 in 2015, based on extrapolation from respondent data (Table 3). Over the same period, the number of graduate faculty members is projected to grow 19% from 1,608 in 2010 to 1,969 in 2015. The percentage of faculty members considered graduate/research faculty is expected to increase slightly from 32.3% to 34.4%.

The number of residents and fellows is expected to increase 58% from 576 in 2010 to 920 in 2015, based on extrapolation from respondent data (Table 4). The average number of residents/fellows per school/college in 2010 was 4.6. Overall, the number of graduate students is expected to increase 17% from 3,295 in 2010 to 3,852 in

Table 2. Anticipated Growth in the Number of Entry-Level PharmD Graduates per School/College: 2010, 2012 and 2015

Category	Entry-Level PharmD Graduates
Will add entry-level PharmD graduates on the current campus during 2010-2015 (%)	38.9
Will add entry-level PharmD graduates at new or branch campuses during 2010-2015 (%)	8.3
Will not be adding entry-level PharmD graduates during 2010-2015 (%)	51.4
Average number of entry-level PharmD graduates per program in 2010	99
Average number of entry-level PharmD graduates per program in 2012	112
Average number of entry-level PharmD graduates per program in 2015	119

Table 3. Anticipated Growth of FTE Pharmacy Faculty per School/College: 2010, 2012, 2015

Category	Full-Time Equivalent (FTE) Faculty
Will add FTE faculty on the current campus during 2010-2015 (%)	75.6
Will add FTE faculty on new or branch campuses during 2010-2015(%)	17.9
Will not be adding faculty (%)	14.1
Average number of FTE faculty per program in 2010.	41.1
Average number of FTE faculty per program in 2012.	45.9
Average number of FTE faculty per program in 2015.	48.5

2015, based on extrapolation from respondent data (Table 5). The number of postdoctoral fellows is expected to increase 23% from 851 in 2010 to 1,059 in 2015 (extrapolated). Twenty-three of 77 programs projected having no graduate students over the 2010-2015 period. The largest graduate program reported 200 graduate students and no plans for growth through 2015. The average number of graduate students per program in 2010 was 28.

Table 6, which portrays time-trend data for faculty vacancies, shows a downward trend from 2007 to 2009, despite increased numbers of colleges and schools. Table 7, which lists reasons for vacancies, shows downward trending in all areas except vacancies created by leaving for industry positions. The 13 vacancies in this category were similar to 11 vacancies in 2008 and substantially less than 24 vacancies in 2007.

DISCUSSION

Mean entry-level PharmD graduates, regional geographic distribution, and percentage of new educational

Table 4. Anticipated Growth in Residents and Fellows per School/College:2010, 2012, 2015

Category	Residents and Fellows
Will add residents and/or fellows during 2010-2015 (%)	69.2
Will not add residents or fellows (%)	23.1
Average number of entry-level residents and/or fellows per program in 2010.	4.9
Average number of number of entry-level residents and/or fellows per program in 2012.	6.3
Average number of entry-level residents and/or fellows per program in 2015.	7.8

institutions were similar between the respondents in this survey and all pharmacy colleges and schools in the United States. Graduate student enrollment was somewhat lower in the respondent group, but the difference was less than 10%. We judged that having relatively fewer new colleges and schools in the respondent group would result in conservative estimates of growth because new institutions will perforce be adding faculty members and graduates through the study period.

The survey responses suggest that pharmacy colleges and schools anticipate growth in all areas from 2010 to 2015. A growth agenda is presented despite continuing weakness in the national economy, evidence of fewer jobs in pharmacy practice, and uncertainties about healthcare reform and how pharmacists will participate in it.

The prediction of continued growth in the number of PharmD graduates may be related to protracted publicity about pharmacist shortages, including the expectation that the shortage will continue for many years.¹⁹ The projected 21% increase in PharmD graduates from 2010 to 2015 would raise the number of graduates to approximately 13,856 per year. Approximately half of the survey respondents reported some expansion over the next 5 years. This expansion occurs in what currently appears to be a tightening market for PharmD graduates.²⁰ The Aggregate Demand Index, a national survey about the unmet demand for pharmacists, has shown downward trending for pharmacists over the last 3 years.²¹ In December 2009, the demand for community pharmacy practitioners fell below “3,” the level of balance between supply and demand.²² These data appear to support the observation that the job market for pharmacists has tightened substantially. A longer-term tight job market could result in salary reductions for pharmacists and a decreased applicant pool of pharmacy students, which could present a challenge to filling PharmD programs with qualified applicants.

The percentage of FTE faculty positions is expected to increase 13% from 2010 to 2015. This level of growth would seem optimistic, considering that the estimates submitted by respondents do not include faculty member losses through retirements. Thus, the actual number of faculty members needed exceeds the survey estimates. The AACP Faculty Vacancy Survey data show that earlier reports of increasing faculty shortages⁶ are not supported by newer data showing a downward trend in vacancies over the past 3 years. This trend is observed across all disciplines including pharmacy practice, which has been a cause of much concern in recent years. Even faculty member retirement, an important factor in earlier reports, showed a downward trend. We suggest that economic factors contributing to these trends include reduced value of retirement accounts and fewer positions in settings

Table 5. Anticipated Growth in Graduate Students, Postdoctoral Fellows, and Graduate Faculty per School/College: 2010, 2012, 2015

Category	Graduate Students	Postdoctoral Fellows	Graduate Faculty
Will add to this category in the next 5 years during 2010-2015 (%).	39.3	20.2	21.4
Average number in this category per program in 2010.	27.9	7.2	13.6
Average number in this category per program in 2012.	29.8	8.1	15.6
Average number in this category per program in 2015.	32.6	9.0	16.7

such as industry and health care. If these trends hold, the ability to find qualified faculty members to meet growth goals is likely more favorable than would have been forecasted less than 5 years ago, but still may not satisfy the demands of the growth agenda shown in our data.

In this survey, 69.2% of respondents reported they would add residents and/or fellows over the next 5 years, suggesting that pharmacy colleges and schools are supporting the residency expansion. This projected growth increase in postgraduate training, from a mean of 4.9 to 7.8 residents per school, represents a 60% increase over the 5-year period, or approximately 9.8% growth annually.

ACCP and ASHP goals for residency growth have been described previously.^{8,23} While healthcare systems sponsor the bulk of residencies, colleges and schools of pharmacy either fund or have direct affiliation with 23% of all ASHP-accredited first-year residency programs. The 9.8% annual growth rate identified in this survey is similar to the 9.6% college-based annual growth rate identified in a 2009 survey of residency programs.²⁴ The 2009 study estimated that a growth rate of 17% per year would be required to reach ACCP goals for residency supply. Regarding residency supply and demand, we found that there were multiple applicants for each 2010 ASHP-accredited first-year (PGY1) residency position, and only 61.8% (1114/1801) of these applicants matched with a program.²⁵ Considering that graduate numbers will

continue to increase through this decade, this suggests a sufficient demand for these training positions. Obtaining a satisfying position after completion of the residency is critically important. The combination of societal needs for pharmacists providing direct patient care and filling clinical faculty positions in colleges and schools of pharmacy suggest that jobs will be available for residency-trained faculty members.

The projected 60% growth in this category also included fellowship programs. Fellowship programs, second-year (PGY2) residencies, and PhD programs in experimental therapeutics are critical to creating a sufficient supply of faculty members qualified for tenure-track clinical academic positions. Although the number of individuals entering fellowship training has decreased significantly over the past few years and there is considerable debate about whether fellowships or PhD programs provide the best training for clinical pharmaceutical scientists, the 212 clinical sciences/practice vacancies in colleges and schools of pharmacies in 2009 suggest a continuing need for fellowships. Robust growth of fellowship programs could help to fill this need.

The number of students completing graduate degrees is expected to increase 17% between 2010 and 2015, which is slightly less than that of PharmD graduates. The number of postdoctoral research fellows is expected to increase 23% by 2015. Over the same period, the number of graduate faculty members is projected to grow 19%, or roughly 1.5 times the expected growth for faculty in the professional pharmacy program. Although this study did not differentiate between master's and PhD-level programs, 2010

Table 6. Number of Pharmacy Faculty Vacancies^a: Total and by Discipline, 2007 to 2009

Variables	2007	2008	2009
Schools Reporting	94 of 97	93 of 97	101 of 114
Total Vacant Positions	595	425	396
Administration	42	25	19
Pharmaceutical Sciences	173	112	124
Clinical Sciences/Practice	306	265	212
Social Administrative Sciences	47	39	32
Research	27	23	9

^a Data source: AACP Faculty Vacancy Surveys (D. Taylor, American Association of Colleges of Pharmacy, written communication, September 11, 2010)

Table 7. Reasons for Pharmacy-Faculty Vacancies^a, 2007 to 2009

Reason for Vacancy	2007	2008	2009
New Positions Created	239	179	147
Left for a Pharmacy-Practice Position	25	41	33
Moved to Another School	69	42	43
Left for an Industry Position	24	11	13

^a Data source: AACP Faculty Vacancy Surveys (D. Taylor, American Association of Colleges of Pharmacy, written communication, September 11, 2010)

AACP data show 1,079 master's and 2,929 PhD students in 2009, and 984 master's and 3,051 PhD students in 2010 (D. Taylor, American Association of Colleges of Pharmacy, e-mail communication, 2010).²⁶ This significant number of students in pharmacy-based graduate programs with the prospect of a 17% growth rate by 2015 and concomitant growth in research faculty and postdoctoral fellows suggest that universities are committing resources in anticipation that this area of education can contribute to their success. Unfortunately, the broad scope of this survey does not allow further exploration of growth in this area. Considering the high growth projections, we recommend additional research to more completely describe and explain this growth area.

Interpreting the growth predicted by this survey hinges on progress in healthcare reform, responses by other health professions to the primary-care shortfall, and the direction of the future US economy. The number of Americans lacking adequate access to primary health care is staggering. A 2009 AACP Issue Brief entitled "Pharmacists' Contributions to Primary Care in the US—Collaborating to Address Unmet Patient Care Needs" cites reports that project a shortfall of 44,000 primary care providers by 2025. The same paper notes that more than 56 million Americans lack adequate access to primary health care because of shortages in primary care physicians.²⁷ A 2010 editorial in *The Wall Street Journal* addressing the same concern asked how our healthcare system will provide care "for the estimated 30 million more patients who will be insured under the health law passed earlier this year."²⁸ How pharmacists will contribute to the resolution of this problem is a critical issue.

Over the past decade, dialogue and debate within pharmacy has centered on the shortage of pharmacists. While this has been a relevant anchor for discussion in the past, changes in the job market and increased PharmD graduates suggest that perhaps we need to reassess the focus. Data from this study suggest that pharmacy colleges and schools are able to provide more graduates, residents, fellows, and researchers. What has not been sufficiently studied and disseminated is how the "products" of our educational, training, and research programs will contribute to the resolution of larger healthcare issues—both quantitatively and qualitatively. How growth as predicted in this study can alleviate the lack of primary healthcare providers, improve access to primary care, and address patients' need for appropriate medication management has yet to be determined.

It seems certain that medical school expansion will result in more physicians, but how many will choose primary care is unknown. Meanwhile, nursing has been unable to overcome the challenge of not having an adequate number of qualified faculty members to expand training.

Through its education, training and research endeavors, the pharmacy profession may be well positioned to contribute immediately and substantively to resolving national primary care challenges, thus justifying the growth predictions found by this study. However, for this to happen, the relationship between major problems in health care and possible contributions by pharmacists must be well defined, supported by research, and broadly accepted.

Our projections are based on data provided by about two-thirds of all pharmacy programs. The similar mean class size, geographic distribution, and ratio of new to established schools suggest that respondents are representative and thus suitable for estimates. Because new programs are relatively fewer among the respondent population, the growth projected is probably lower than what will actually occur. This survey did not distinguish between pharmacy residencies and fellowships; therefore, the growth rate of each of these programs cannot be determined from our survey data. Likewise for graduate programs, the study did not distinguish between master's and PhD degrees or identify degrees by discipline. Although this lack of specificity was chosen as a means to increase the response rate by keeping the survey shorter, further research will be needed to address growth more precisely in each type of program.

CONCLUSIONS

Despite a continued weak national economy, substantial growth in pharmacy education, training, and research is planned for the period 2010 to 2015. The data project almost 14,000 PharmD graduates by 2015. The challenge of finding sufficient faculty to support this growth is aided somewhat by recent faculty vacancy data trends, which suggest better availability of qualified faculty members in all disciplines. University-sponsored pharmacy residencies and fellowships have the highest projected growth levels of all segments studied (58% over 5 years), supporting ACCP and ASHP goals to increase residency-level training in the US pharmacist workforce. Growth projections for graduate students, postdoctoral fellows and research faculty members suggest a strong commitment to increasing the research enterprise over the next 5 years. Realization of the projected growth may be influenced by the economy, growth plans in medicine and nursing, the progress of healthcare reform, and how the pharmacy profession can demonstrate the utility of its practitioners and researchers in resolving national healthcare problems.

ACKNOWLEDGMENTS

The authors acknowledge fellow members of the subcommittee of the American Association of Colleges of

Pharmacy (ACCP) Taskforce on the Faculty Workforce that addressed faculty data and projections of future needs during the 2009-2010 academic year: Brian L. Crabtree, PharmD, University of Mississippi School of Pharmacy; Lisa Deziel-Evans, PhD, Nova Southeastern University College of Pharmacy; and Russell B. Melchert, PhD, University of Arkansas for Medical Sciences College of Pharmacy. The subcommittee worked together on the survey cited in this paper and reported preliminary results at the 2010 ACCP Annual Meeting in Seattle, Washington.

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