

RESEARCH

Non-Doctoral and Dual Degree Offerings in US Pharmacy Schools

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Objective. To determine the number and types of non-terminal degree programs offered at US schools and colleges of pharmacy.

Methods. The websites of 136 schools and colleges of pharmacy that offered the Doctor of Pharmacy (PharmD) degree and were accredited by the Accreditation Council for Pharmacy Education were examined to see if they also offered any non-terminal degrees. The school web sites were also compared to identify any variations in degrees offered based on class size, institution type (public or private), and age of program.

Results. Thirty programs did not offer any additional degree programs. Twenty-three schools (17%) offered a bachelor's degree(s) program, 17 of which were standalone Bachelor of Science programs, five were restricted availability or pass-through degrees and one offered both. Restricted availability is a bachelor's degree given to students who reach milestones in the PharmD program, but they must be in the PharmD program to receive the degree. Research-based and administrative-based master's degree programs were offered by 56 (41.1%) and 28 (20.6%) schools respectively. Finally, 92 (67.6%) schools offered dual degree programs where students could simultaneously earn their PharmD and an additional degree.

Conclusion. Given the challenges that US pharmacy schools face with decreasing applicants and lower enrollment in PharmD programs, they may find this data helpful as they consider solutions such as adding additional degree programs.

Keywords: BSPS, MS, dual degree, degree programs, non-terminal degree programs

INTRODUCTION

Pharmacy education is forever changing and adapting to the needs of the profession. One current challenge is that after a period of rapid growth and expansion, applications to pharmacy programs have slowed.^{1,2} Enriching the applicant pool is the first priority of the American Association of Colleges of Pharmacy's latest strategic plan, with hope that a concerted effort of recruitment and advocacy for provider status will lead to a healthy supply of well-qualified future pharmacists.³ While efforts are being made to expand the pipeline of future Doctor of Pharmacy (PharmD) students, it is also

prudent in times of uncertainty for pharmacy schools to diversify their degree offerings so they are not solely financially dependent on enrollment in their PharmD program.

Pharmacy programs are well positioned to offer degrees beyond the PharmD as they employ faculty members with a wide variety of expertise, ranging from the medical arts and direct patient care to the pharmaceutical and administrative sciences. Pharmacy programs use all of this expertise to deliver the curriculum leading to the PharmD degree. However, the expertise of pharmacy faculty members is integral to a wide range of fields and thus the diverse capabilities of pharmacy faculty members at the college and university level raise the possibility of pharmacy schools developing other degree programs beyond the PharmD.

A PharmD degree can lead to careers in fields such as industrial pharmacy (including regulatory affairs, medical sales, medical writing, etc), governmental regulatory

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agencies, managed care, pharmacy benefits management, cosmeceuticals, academia, engineering, and biomedical nanotechnology. However, some of these career pathways do not necessarily require the employee to obtain or maintain a professional license. As early as 2007-2008, the Argus Commission began to examine the future of pharmacy education beyond training students in the provision of pharmaceutical care.⁴ While many of the recommendations and findings have been incorporated into pharmacy curricula, some, eg, the creation and use of nanotechnologies to deliver drugs, remain outside the general pharmacy curriculum. The use of nanotechnology in drug delivery is just one example of the expertise that pharmacy faculty members have but generally do not teach to their PharmD students. Some pharmacy programs have begun to expand their degree offerings beyond the PharmD to offer non-terminal degrees. These degrees offer an opportunity for pharmacy students to specialize their training or allow the pharmacy program to attract non-PharmD students to pharmacy related-fields like pharmacogenomics or drug development that do not require a pharmacist license. Attracting non-PharmD students to pharmacy-related degree programs could help to increase overall pharmacy school enrollment.

Over the past decade, the field of pharmacy has been expanding and creating partnerships with other disciplines in healthcare, business, and the sciences, helping to teach students how to run a business, work in a data-rich environment, and supervise and motivate people.⁵ Opportunities exist for pharmacy schools to offer additional degree programs or to collaborate with other schools within the college or university, or even with another university, to create dual degree programs. The PharmD/Master of Business Administration (MBA) dual degree program is the most prevalent dual degree program offered and has been described elsewhere⁶; other programs offer unique standalone degree or dual degree opportunities that could potentially assist pharmacy programs in increasing their enrollment and using available resources to the fullest extent. The purpose of this study was to explore the current landscape of these non-terminal degree offerings in US pharmacy programs and to help programs looking to diversify their degree offerings explore potential opportunities.

METHODS

The authors used a list of 136 US pharmacy schools with ACPE pre-candidate, candidate, or accredited status as of November 2016.⁷ Program demographics (public/private, first-year class size, and time since enrolling their first PharmD class) were obtained from the AACP profile of pharmacy students² and ACPE accreditation history

website.⁷ Programs were defined as “emerging” or “mature” based on their initial date of ACPE accreditation (with programs enrolling their first class prior to 2000 categorized as mature and programs enrolling their first class in 2000 or later as emerging), as the Bachelor of Science in Pharmacy degree was no longer available to students enrolling after July 2000.⁸ Program websites were reviewed by the authors in November and December 2016, and non-terminal degree (ie, non-PhD) offerings other than a PharmD were noted. Degree offerings were separated into Bachelor of Science (BS) programs, non-terminal Master of Science (MS) degrees, and dual degrees. Variations based upon class size, institution type (public or private), and age of program (mature or

Table 1. Research-based Master’s Degree Programs Offered by US Schools and Colleges of Pharmacy

| Majors for Master of Science Degree | Programs, No. (%) |
|---|--------------------------|
| Pharmaceutical sciences | 31 (22.8) |
| Medicinal chemistry | 11 (8.1) |
| Pharmaceutics | 10 (7.3) |
| Pharmacology | 7 (5.1) |
| Pharmacology/Toxicology | 7 (5.1) |
| Biotechnology | 4 (2.9) |
| Clinical research | 3 (2.2) |
| Biomedical sciences | 3 (2.2) |
| Biomedical Nanotechnology | 3 (2.2) |
| Toxicology | 3 (2.2) |
| Pharmacogenomics | 2 (1.5) |
| Neuroscience | 2 (1.5) |
| Pharmaceutical engineering | 2 (1.5) |
| Pharmaceutical sciences research & policy | 2 (1.5) |
| Clinical lab sciences | 1 (.7) |
| Cytotechnology and molecular cytology | 1 (.7) |
| Drug delivery and clinical pharmacology | 1 (.7) |
| Drug design and discovery | 1 (.7) |
| Epidemiology | 1 (.7) |
| Forensic science | 1 (.7) |
| Integrated biological sciences | 1 (.7) |
| Integrated pharmaceutical medicine | 1 (.7) |
| Molecular Biosciences | 1 (.7) |
| Pharmaceutical/chemical product development | 1 (.7) |
| Pharmacodynamics | 1 (.7) |
| Pharmacognosy | 1 (.7) |
| Pharmacometrics | 1 (.7) |
| Radiopharmaceutical sciences | 1 (.7) |
| Regulatory science | 1 (.7) |

emerging) were also explored. Descriptive statistics, including chi square for analyses of categorical data were used.

RESULTS

Of the 136 pharmacy schools and colleges reviewed, 26 (19.1%) did not offer any additional non-terminal degree beyond the PharmD; the large majority of these schools (n=25; 96.2%) were private institutions. Pharmacy schools with first-year class sizes of 50-100 students were significantly less likely than larger programs to offer any additional non-terminal degree program other than the PharmD program (72.5% vs. 89.6%; *p* = .016).

Of the 110 programs offering non-terminal degree programs beyond the PharmD, a wide variety of degree programs were offered. Research based master’s degree programs were offered by 56 (41.1%) institutions. The most common research-based master’s degree programs were in pharmaceutical sciences (n=31), medicinal chemistry (n=11), and pharmaceuticals (n=10; Table 1). Research-based master’s degrees were twice as likely to be offered by public institutions than at private institutions (56.1% vs 27.1%; *p* < .001). Administrative-based master’s degrees were offered by 28 (20.6%) institutions; pharmacy and health system administration were the most common administrative-based master’s degree programs (n=10), followed by health outcomes (n=4) and regulatory affairs (n=4; Table 2).

Dual degree programs were offered by 92 programs (67.6%), and of these, 53 (57.6%) offered multiple dual degree programs. The most common dual degree programs were the PharmD/MBA (n=67), the PharmD/MPH (n=35), the PharmD/PhD (n=35), and the PharmD/MS (n=26). Less common dual-degree offerings included a PharmD/Master of Health Informatics (n=7), PharmD/JD (n=5), PharmD/MPA (n=4) and PharmD/Master of Clinical Research (n=3). There were also many unique dual degree options, including a PharmD/BS in forensic science and PharmD/Equestrian Studies degree. The maximum number of dual-degree programs offered by a school was eight.

Bachelor’s degree programs were offered by 23 programs. Six programs offered a “pass-through” bachelor’s degree, provided to students who had completed four years within the university (2 years of pre-pharmacy and 2 years of pharmacy school in a 2+4 program or 4 years of pharmacy school in a 0-6 program). This pass-through degree was offered in pharmacy studies (n=3), pharmaceutical science (n=2), or medicinal chemistry (n=1). Beyond the pass-through degree, 18 programs offered one or more bachelor’s degree programs, the majority of which were BS in Pharmaceutical Sciences

Table 2. Administration Based Master’s Degrees Offered by US Schools and Colleges of Pharmacy

| Major for the Master of Science Degree | Programs, No. % |
|---|------------------------|
| Pharmacy or Health System Administration | 10 (7.3) |
| Health Outcomes | 4 (2.9) |
| Regulatory Affairs | 4 (2.9) |
| Public Health | 3 (2.2) |
| Pharmacoeconomics | 3 (2.2) |
| Industrial Pharmacy | 2 (1.5) |
| Healthcare decision analysis | 1 (.7) |
| Management of drug development | 1 (.7) |
| Medical health sciences | 1 (.7) |
| Pharmaceutical affairs | 1 (.7) |
| Pharmacy leadership and administration | 1 (.7) |

programs (n=12) (Table 3). The majority of schools offering bachelor’s degrees (n=16) only offer one bachelor’s degree option.

There were significant differences in the likelihood that a program offered degree options beyond the PharmD based upon class size as well as the age of pharmacy program. Regarding class size, programs with PharmD class sizes of 100 students or fewer were less likely to offer additional degree options (Table 4). Only 5.8% of these programs offered a standalone bachelor’s degree (versus 20.9% of larger programs; *p* = .01). Research- or administrative-based master’s degrees were also less likely to be offered by programs with class sizes of 100 or fewer (36.2%) compared to programs with 101-150 students (60.5%; *p* = .03) and 201 or more students (76.9%; *p* = .01). Finally, dual degree programs were less likely

Table 3. Bachelor’s Degrees Offered by US Schools and Colleges of Pharmacy

| Majors for the Bachelor of Science Degree | Programs, No. (%) |
|--|--------------------------|
| Pharmaceutical Sciences | 12 (8.8) |
| Clinical Laboratory Sciences | 4 (2.9) |
| Toxicology | 3 (2.2) |
| Healthcare and Business | 2 (1.5) |
| Applied Sciences | 1 (.7) |
| Biochemistry | 1 (.7) |
| Cosmetic Science and Formulation Design | 1 (.7) |
| Global Healthcare Management | 1 (.7) |
| Microbiology | 1 (.7) |

Table 4. Degree Programs Offered Based on the Class Size of the Pharmacy Program

| | Class Size | | | |
|--------------------------------|---------------------------|----------------------------|----------------------------|-------------------------|
| | 50-100 n=69 No. (%) | 101-150 n=38 No. (%) | 151-200 n=16 No. (%) | >201 n=13 No. (%) |
| Bachelor's degree(s) offered | 4 (5.8) | 8 (21.0) | 3 (18.8) | 3 (23.0) |
| Master's degree(s) offered | 25 (36.2) | 23 (60.5) | 8 (50.0) | 10 (76.9) |
| Dual degree program(s) offered | 40 (58.0) | 31 (81.6) | 10 (62.5) | 11 (84.6) |

to be offered by programs with class sizes of 100 or fewer (58.0%) compared to larger programs (77.6%; $p=.02$). Moreover, mature pharmacy programs were significantly more likely than emerging programs to offer each of the degrees we examined (Table 5).

In addition to these various degrees, some pharmacy programs had expanded their scope even further. Twenty-six schools offered certificates or concentrations within the PharmD program. These certificates and concentrations were offered in a wide variety of topic areas, including nephrology, diabetes, pharmacy research, health information technology, healthcare operations management, medication safety, business administration, cosmetic science, drug development, rural and urban pharmacy services, gerontology, maternal and child health, nuclear pharmacy, and Spanish. Additionally, two pharmacy programs offer pharmacy technician certificate programs.

DISCUSSION

The vast collective expertise of faculty members at US pharmacy schools can be used to create additional degree opportunities. Some additional degree opportunities, such as an MS degree in pharmacy administration or medicinal chemistry, are common, while others present more unique opportunities. For example, the University of Toledo offers a bachelor's degree in cosmetic science,⁹ a field that involves pharmaceuticals, physiological chemistry, toxicology, and pharmacology. With the addition of one full-time faculty member, a few volunteer adjunct faculty members, and 10-15 invited speakers, the program was able to create a unique new major.⁹ Beyond their BS programs, two schools offered a master's degree in pharma-

ceutics with a concentration in cosmetic science, and two additional programs offered the degree within their university but separate from the pharmacy school.¹⁰

Dual-degree programs and non-terminal degree programs (including bachelor's degree programs and master's degree programs in research, clinical, or administrative sciences) are methods that a pharmacy program can utilize in order to increase their student enrollment and diversify their offerings. Each of these offerings present both opportunities and challenges that need to be considered. As there is diversity in the characteristics of pharmacy programs themselves (including public vs private, affiliation with a health science university or academic medical center, urban vs rural, and variations in class size), some degree options may be more appealing or more feasible than others.

Potential advantages of master's programs include their length (shorter than PhD programs) and freedom within their curricular design compared to undergraduate programs, which generally require completion of general education requirements. As master's degree programs are offered by about half of all pharmacy schools, literature exists that describes curricular development and program assessment, and reviewing that may be helpful to programs considering new degree offerings.⁸⁻¹¹ Bachelor's degrees in pharmacy have been complicated by the phasing out of the Bachelor of Science in Pharmacy degree, which ended with the 2000-2001 academic year.⁸ During this transition, a study was conducted that determined a need within industry for graduates with a bachelor's degree in pharmaceutical sciences.¹² An additional study in 2013 found that 29 universities were offering this degree, with 18 of which were at schools that also offered the

Table 5. Degree Programs Offered Based on Program's Age

| Type of Degree | Emerging Programs (n=53) | Mature Programs n=83 |
|--|-----------------------------|-------------------------|
| | No. (%) | No. (%) |
| Bachelor's degree(s) offered (standalone only) | 1 (1.9) | 17 (20.5) ^a |
| Master's degree(s) offered | 11 (20.8) | 55 (66.2) ^b |
| Dual degree program(s) offered | 24 (46.2) | 68 (81.9) ^c |

^a $p=.001$, ^b $p<.001$, ^c $p<.001$ vs emerging programs

PharmD degree.¹¹ This study also found that a Bachelor of Science in Pharmaceutical Sciences (BSPS) degree was a good option for people looking to work within the pharmaceutical industry, as 90% of BSPS graduates from one program pursued jobs and were employed in the pharmaceutical industry after graduation.¹¹ We found that the prevalence of pharmacy schools offering bachelor's degrees has increased since 2013.

Dual-degree programs can be easier to begin than other programs as they can be designed using curricula, courses, and faculty members that already exist at the institution. It is also possible to arrange a dual degree program with another institution, as a student who completes a dual-degree program generally receives a distinct degree from each school. Dual degree programs were the most common degree option offered beyond the PharmD degree at the 136 schools in our study. The prevalence of these degree programs has increased substantially (n=92) compared to findings from a study performed in 2012 (n=52).⁵ Dual degree programs can also help students develop skills to enter nontraditional career pathways within and outside of pharmacy.¹² Studies have found that graduates with a PharmD/MBA dual degree had higher starting salaries and mean total first-year compensation compared to that of graduates who had only completed a PharmD degree.¹³ Furthermore, over 40% of residency program directors prefer candidates holding a dual degree.¹⁴ There are several helpful articles that describe dual pharmacy programs with the MBA,¹⁵⁻¹⁷ and Master of Public Health (MPH) degree,^{18,19} and another article that describes both PharmD/MPH and PharmD/MPA programs.²⁰ There also seems to be extensive interest in creating academic teaching opportunities for pharmacy students,^{21,22} but we could not find an example of a dual PharmD/Master of Education (MEd) degree program, so this may be another dual degree option.

One of the more intriguing findings was the difference between emerging and mature pharmacy programs in offering additional degrees. Anecdotally, many new pharmacy schools focus on getting the PharmD program fully accredited before they begin to expand their degree offerings. As such, a number of emerging schools that are now fully accredited by ACPE may perhaps be ready to consider additional degree programs. Additional degree programs may also be useful as applications to PharmD degree programs have entered a challenging period, with fewer applicants applying for an increasing number of first-year positions.^{1,2} Diversification of degree programs beyond the PharmD degree can also serve as a source of new revenue streams to support existing schools and colleges of pharmacy.

There are several limitations to this study which merit mention. The focus of this study was to examine degree programs offered by schools and colleges of pharmacy. Because of the various organizational structures of different universities, the prevalence of some degree programs may have been underestimated. For example, we found that cosmetic science programs, were offered as a master's degree by two pharmacy programs, however two additional universities with pharmacy programs offered the degree within a different school. Another limitation is in regard to the number of schools conferring "pass through" bachelor's degrees. Because the degree is generally restricted to students who are enrolled in the professional pharmacy program, it may not have been clearly advertised or described on the program websites that we searched. The authors made additional efforts to identify this information, including examining data on the types of degrees conferred by the institution at graduation (if available).

CONCLUSION

In summary, there are a plethora of additional degree options that can be offered by pharmacy programs that build on the expertise of their existing faculty. Many pharmacy programs have a strong existing infrastructure from past years of record enrollments. Rather than allow facilities and faculty members to go unused or underutilized if PharmD enrollment continues to dwindle, diversification by developing additional undergraduate and master's degree programs may be an intriguing and viable option.

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