

RESEARCH

Education in Pediatrics in US Colleges and Schools of Pharmacy

William Allan Prescott, Jr., PharmD,^a Elizabeth M. Dahl, PharmD Candidate,^a and David J. Hutchinson, PharmD^b

^aSchool of Pharmacy and Pharmaceutical Sciences, University at Buffalo, Buffalo, New York

^bWegmans School of Pharmacy, St. John Fisher College, Rochester, New York

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Objective. To determine the extent to which pediatrics is taught at US doctor of pharmacy (PharmD) programs and to characterize what is being taught and how.

Methods. A 40-question online survey instrument was sent to accredited and candidate-status US PharmD programs.

Results. Of 86 participating programs (67.2% response rate), 81 (94.2%) indicated that pediatric topics were included in their required classroom curricula (mean, 21.9 contact hours). A pediatric elective course was offered by 61.0% of programs (mean, 25.9 contact hours). Advanced pharmacy practice experiences (APPEs) in pediatrics were offered by 97.4% of programs, with an average of 27 students per program completing this practice experience annually.

Conclusions. Almost all responding programs incorporated pediatrics in their required curricula. Pediatric elective courses provided an adequate mean number of contact hours, but 39.0% of programs did not offer an elective course. One-fifth of students completed a pediatric APPE prior to graduation. Continued expansion of pediatric-focused classroom and experiential curricula across US PharmD programs is recommended.

Keywords: pharmacy education, pediatrics, curriculum

INTRODUCTION

The Accreditation Council for Pharmacy Education (ACPE) Accreditation Standards and Guidelines identify the training of pharmacy students to provide care for special populations (eg, pediatric patients) as 1 of the science foundation elements essential to the development of pharmacists.¹ They recommend that doctor of pharmacy degree (PharmD) programs integrate pathophysiologic and pharmacotherapy alterations, dosage calculation and adjustments, and drug monitoring for positive and negative outcomes for special populations into their curricula.¹ However, the ACPE guidelines do not specifically address the extent to which pediatrics should be incorporated into the curricula nor do they address which specific pediatric topics should be covered.

The Pediatric Practice and Research Network (PRN) of the American College of Clinical Pharmacy (ACCP) published recommendations in 2005 that outlined curricular standards for pediatrics in pharmacy programs across

the United States (US) and Canada.² This group recommended that the curricula at all pharmacy programs should include a minimum of 25 hours of classroom instruction in pediatrics, specifying that pediatric topics be introduced during the first year of the PharmD program. This group also recommended that an elective course in pediatrics consisting of 16 to 32 contact hours should be available to students and that all pharmacy schools offer students at least 1 practice experience in pediatrics.² Whether pharmacy colleges and schools across the country have abided by these recommendations is unknown. The purpose of this study was to determine the extent to which pediatrics is taught at US PharmD programs and to characterize what content is being taught and how it is being taught.

METHODS

One hundred twenty-eight candidate-status and accredited PharmD programs in the United States and its territories were identified using the ACPE website.³ Programs having precandidate status during the 2012-2013 academic year and programs that were located outside the United States or Puerto Rico were excluded. A 40-question survey instrument was designed to collect information from responding programs about their pediatric

Corresponding Author: William Allan Prescott, Jr., PharmD, University at Buffalo School of Pharmacy and Pharmaceutical Sciences, 218 Kapoor Hall, Buffalo, NY 14214. Tel: 716-645-4780. Fax: 716-829-6093. E-mail: prescott@buffalo.edu

curricula. Skip logic, which directs the respondent through different paths in the survey based on their responses, was integrated to minimize survey fatigue. Therefore, the exact number of questions requiring an answer depended upon survey instrument responses. Demographic data for the responding programs that were not readily available on the American Association of Colleges of Pharmacy (AACCP) or ACPE websites were requested from the programs (eg, number of students enrolled and pediatric-focused faculty members). PharmD program locations were retrieved from the ACPE website.³ The current accreditation status and the years that each program had been in existence were requested from the programs and verified using data available on the ACPE website. Private and public institution data were retrieved from the Pharmacy College Application System website and individual PharmD program websites.⁴ If the curriculum of a responding program included content in pediatrics, information about the extent and type of required and elective classroom coursework, experiential teaching related to pediatrics, and instructional methodologies used to teach pediatrics were requested. To pretest the survey instrument, the clarity of question composition was validated by a pharmacy faculty member not directly involved in this study. During the validation process, this individual was asked to provide feedback regarding whether the survey instrument adequately addressed the study's primary objective (ie, determining the extent to which pediatrics is taught in the curricula of US PharmD programs) and the secondary objectives (ie, characterizing what pediatric content is being taught and how it is being taught). The survey instrument was revised based on the faculty member's written feedback.

An electronic hyperlink to the survey instrument was e-mailed to faculty members at all 128 ACPE-accredited and candidate-status PharmD programs in the US and its territories. SurveyMonkey (SurveyMonkey, Inc, Portland, OR) was used to collect survey responses. The survey instrument was initially distributed on May 7, 2013, using the curriculum special-interest group e-mail list (purchased from AACCP) and a reminder was e-mailed to all programs on this list 2 weeks later (May 21, 2013). To enhance the survey response rate, pharmacy college and school websites for programs that had not yet responded were reviewed to identify associate deans of academics as well as faculty members specializing in pediatrics. An e-mail was distributed to this targeted list on June 4, 2013, and a reminder e-mail was sent 2 weeks later (June 18, 2013) to programs that still had not responded. The survey was open for 8 weeks, closing on July 2, 2013.

Survey responses were downloaded into Microsoft Excel. In the event multiple responses were received from the same program, data were combined to account for all

responses. However, when conflicting answers were chosen for certain questions, such as those asking for a yes or no response, data could not be combined. To account for these isolated instances, an order of preference was pre-assigned, based on the responding individual's position, with highest preference given to faculty members considered most likely to have the best understanding of the classroom and experiential curriculum in pediatrics at their school, and lowest preference given to those less likely to understand the intricacies of the curriculum in pediatrics. Responses were chosen based on the following order of preference: faculty members specializing in pediatrics, pharmacy faculty members, department chair, associate dean, and dean. The distribution of responses was determined using demographic data, accreditation status, and type of institution (public vs private). Demographic data were grouped into 9 divisions based on geographic location, as defined by the US Bureau of the Census; New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont; Middle Atlantic: New Jersey, New York, Pennsylvania; East North: Indiana, Illinois, Michigan, Ohio, Wisconsin; West North: Iowa, Nebraska, Kansas, North Dakota, Minnesota, South Dakota, Missouri; South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia; East South: Alabama, Kentucky, Mississippi, Tennessee; West South: Arkansas, Louisiana, Oklahoma, Texas; Mountain: Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming; Pacific: Alaska, California, Hawaii, Oregon, Washington.⁵ Survey responses were analyzed using Microsoft Excel. Frequency and descriptive statistics were used to characterize the extent to which pediatrics was taught, what pediatric content was being taught, and how it was being taught at US PharmD programs. This study was deemed exempt from institutional review board (IRB) approval by the University at Buffalo Social and Behavioral Sciences IRB on April 13, 2013.

RESULTS

Eighty-six of 128 US PharmD programs responded to the survey, yielding a survey response rate of 67.2%. Multiple responses were received from 22 programs. More than 90% of responding programs were ACPE-accredited during the 2012-2013 academic year (Table 1). The survey response rates for accredited and candidate-status programs were 68% (78/114) and 57% (8/14), respectively. The percentage of responding programs that were public or private and the geographic distribution of the programs were similar to those of the sample size as a whole (data not shown). The mean class size for the responding programs was 126 ± 61 students, with approximately

Table 1. Demographics of United States Doctor of Pharmacy Programs Participating in the Survey About Pediatric Education in Pharmacy (N = 86)

Demographic	No. (%)
Accreditation status	
Candidate	8 (9.3)
Accredited	78 (90.7)
Public/private	
Public	44 (51.2)
Private	42 (48.8)
Regional distribution	
East North	13 (15.1)
East South	8 (9.3)
Middle Atlantic	12 (14.0)
Mountain	6 (7.0)
New England	6 (7.0)
Pacific	9 (10.5)
South Atlantic	14 (16.3)
West North	9 (10.5)
West South	8 (9.3)
Other ^a	1 (1.2)
No. years in existence	
≤ 5 years	9 (10.5)
6-10 years	17 (19.8)
11-20 years	9 (10.5)
>20 years	51 (59.3)
No. students per graduating class	
<50	2 (2.3)
51-100	36 (41.9)
101-150	28 (32.6)
151-200	11 (12.8)
>200	9 (10.5)

^aSchool located in Puerto Rico.

three-fourths of responding programs enrolling 51-150 students. The mean full-time, part-time, and adjunct faculty specializing in pediatrics was 1.9, 0.4, and 2.1 per program, respectively. However, only 75.3% (64/85) of the programs employed a full-time faculty member specializing in pediatric pharmacy.

Eighty-one of the 86 responding programs (94.2%) indicated that pediatrics was included in their required curriculum. The mean and median number of contact hours were 21.9±22.9 hours and 16 hours, respectively (range, 1 to 153 hours). Seventy-two programs specified the number of contact hours; 19 (26.4%) programs dedicated more than 25 hours to pediatrics in the core curriculum, whereas 53 (73.6%) programs did not. Pediatrics was introduced during the first, second, and third year of the PharmD program at 42.5%, 39.7%, and 16.4% of responding programs, respectively. However, most of the topics were taught during the third year (60.3%). One respondent indicated that their program was a 3-year accelerated program that

introduced and taught the majority of topics during the third year. Approximately half of responding programs taught the majority of topics as standalone classes, whereas half did so as subsections of adult topics. Of the 41 programs that indicated plans for curricular revision in the next 5 years, 29.3% planned to increase the number of contact hours dedicated to pediatrics. Of the 5 programs that did not include pediatrics in their required curriculum, 3 indicated plans to do so.

Table 2 lists the topics covered in the required curricula of responding programs. More than 80% of programs indicated teaching the effects of renal and hepatic maturation on drug metabolism and elimination, pediatric infectious diseases, immunization, selection of drug doses and dosing forms for pediatric patients, and assessment of renal function in pediatric patients. The types of instruction most commonly employed to teach pediatric topics in the required curricula were lecture (91.8%) and case-based instruction/learning (87.7%) (Table 3). When programs were asked to choose the instructional method used most commonly within their required course(s), lecture was cited by 59.2% of programs, whereas case-based instruction/learning was cited by only 18.3%.

Forty-seven of the 77 responding programs (61.0%) indicated that they offered a standalone pediatric elective course. The mean and median number of contact hours dedicated to pediatric elective courses were 25.9±13.3 hours and 29 hours, respectively (range, 2 to 60 hours). Thirty-five (74.5%) of the programs dedicated more than 16 contact hours to the elective course, whereas 12 (25.5%) did not meet this threshold. The pediatric elective course was offered during the third, second, and first years of the PharmD program at 91.5%, 29.8%, and 2.1% of programs, respectively (1 program offered the elective course during the summer preceding the third year, which was included as a third-year course for the purpose of this study's survey instrument). Eighty-one percent of programs limited the elective course to students in a single year of the program, whereas 19% offered it to students in more than 1 year of the PharmD program. Thirty-four (72.3%) programs enrolled 11-30 students in the elective course. Of the 30 programs that did not offer an elective course, 12 (40%) indicated plans to do so. Seventeen of the 30 programs (56.7%) that reported not offering a standalone elective course did cover pediatric topics in other elective courses.

Table 4 lists the topics covered in the elective curricula of responding programs. Topics varied greatly, with pediatric infectious diseases and neonatology being the only topics included by at least 80% of programs. The types of instruction most commonly used to teach pediatrics in the elective curricula were lecture (75.6%) and case-based instruction/learning (71.1%) (Table 3). When

Table 2. Pediatric Topics Taught in Required Curricula at United States PharmD Programs (n=73)

Topics	Programs, No. (%)
Recommended Topics^a	
Effects of renal and hepatic maturation on drug metabolism and elimination	64 (87.7)
Pediatric Infectious Diseases	63 (86.3)
Acute otitis media	63 (86.3)
Upper respiratory tract infection	47 (64.4)
Meningitis	44 (60.3)
Lower respiratory tract infection (bronchiolitis)	35 (47.9)
Lower respiratory tract infection (community acquired pneumonia)	35 (47.9)
Sepsis	28 (38.4)
Urinary tract infection	22 (30.1)
Immunizations	63 (86.3)
Selection of drug doses and dosing forms for pediatric patients	62 (84.9)
Assessment of renal function in pediatric patients	60 (82.2)
Appropriate sources of drug information for pediatric patients and policies for off-label drug use	56 (76.7)
Therapeutic drug monitoring (eg, of aminoglycosides, vancomycin, antiepileptics)	55 (75.3)
Strategies to reduce medication errors in pediatric patients	51 (69.9)
Fluid and electrolyte therapy (eg, for dehydration)	47 (64.4)
Growth and development (eg, embryonic and fetal development, failure to thrive, growth charts, obesity)	47 (64.4)
Safety issues about neonatal exposure to excipients in pharmaceutical products	46 (63.0)
Nutrition (eg, with infant formulas, vitamins, supplements)	43 (58.9)
Effective communication techniques for parents and children	30 (41.1)
Pediatric physical assessment	27 (37.0)
Clinical toxicology	21 (28.8)
Strongly Encouraged Topics^b	
Drugs commonly used in pregnancy and lactation	54 (74.0)
Cystic fibrosis	53 (72.6)
Psychiatry (eg, attention deficit disorder)	51 (69.9)
Neonatology (eg, apnea of prematurity, chronic lung disease, sepsis, respiratory distress syndrome, nutrition, enteral drug absorption)	29 (39.7)
Neurology (eg, epilepsy, migraine, cerebral palsy)	26 (35.6)
Hematology (eg, thalassemia, sickle cell disease)	25 (34.2)
Oncology	24 (32.9)
Gastroenterology (eg, gastroesophageal reflux, short-gut syndrome)	20 (27.4)
Immunology (eg, juvenile rheumatoid arthritis, lupus, food allergies, anaphylaxis)	17 (23.3)
Human immunodeficiency virus and acquired immunodeficiency syndrome	16 (21.9)
Pediatric cardiology (eg, structural heart defects, cardiomyopathy, cardiac arrhythmias)	16 (21.9)
Substance abuse in adolescence	11 (15.1)
Nephrology (eg, hypertension, nephrotic syndrome, vesicoureteral reflux)	9 (12.3)
Additional Topics^c	
Pulmonology (eg, asthma)	56 (76.7)
Fever	53 (72.6)
Pain management	37 (50.7)
Endocrinology (eg, diabetes)	31 (42.5)
Other	2 (2.7) ^d

^aAmerican College of Clinical Pharmacy Pediatric Practice and Research Network (ACCP Pediatric PRN) 2005 recommended pediatric subject areas.

^bACCP Pediatric PRN 2005 strongly encouraged pediatric subject areas.

^cpediatric subject areas omitted from the ACCP Pediatric PRN 2005 opinion paper.

^deczema (n=1), ketogenic diet (n=1).

Table 3. Types of Pediatric Instruction Used by United States Doctor of Pharmacy Programs

Instructional Method	Programs, No. (%)
Required curriculum (n=73)	
Lecture	67 (91.8)
Case-based instruction/learning	64 (87.7)
Discussion, large group (>12 students)	35 (47.9)
Discussion, small group (≤12 students)	26 (35.6)
Laboratory	26 (35.6)
Team-based learning	25 (34.2)
Problem-based learning	22 (30.1)
Independent learning	20 (27.4)
Self-directed learning	13 (17.8)
Journal club	9 (12.3)
Simulation	7 (9.6)
Workshop	7 (9.6)
Elective curriculum (n=45)	
Lecture	34 (75.6)
Case-based instruction/learning	32 (71.1)
Discussion, small group (≤12 students)	25 (55.6)
Discussion, large group (>12 students)	19 (42.2)
Independent learning	18 (40.0)
Problem-based learning	16 (35.6)
Journal club	10 (22.2)
Self-directed learning	10 (22.2)
Team-based learning	10 (22.2)
Simulation	4 (8.9)
Laboratory	2 (4.4)
Workshop	2 (4.4)

asked to choose the instructional method used most commonly within their elective course(s), 36.4% of the programs cited lecture.

Forty-one of the 77 responding programs (53.2%) offered an introductory pharmacy practice experience (IPPE) in pediatrics, 1 of which required this experience. Of the 36 programs that did not offer an IPPE, 10 (27.8%) indicated plans to develop one. Only 5 of the 21 programs that did not have a full-time faculty member specializing in pediatrics offered an IPPE. Introductory pharmacy practice experiences were offered during the first, second, and third years of the PharmD program in 39.5%, 63.2%, and 65.8% of programs, respectively. The most common IPPE offered by responding programs was inpatient general pediatrics (73.2%) (Table 5). Seventy-four of the 76 responding programs (97.4%) offered an APPE in pediatrics, 3 of which required this experience. The mean class size for these 3 programs was 138 students. One of these programs had 6 full-time and 10 adjunct faculty members specializing in pediatrics, whereas the other 2 reported only 1 full-time faculty member. Of the 2 programs that did not offer an APPE in pediatrics, 1 indicated plans to do

so. Of the 21 programs without a full-time faculty member specializing in pediatrics, 16 offered a pediatric APPE. Among all programs (including those that required a pediatric APPE), a mean of 22 APPE modules were offered (range, 1 to 164 modules), with a mean of 27 students completing a practice experience annually (range, 2 to 164 students). The APPE length ranged from 4 to 6 weeks and was evenly distributed among 4-, 5-, and 6-week modules. Programs indicated that students spent an average of 39.3 ± 8.3 hours per week dedicated to this practice experience (range, 5 to 60 hours). As with IPPE, inpatient general pediatrics was the most common APPE overall (Table 5).

DISCUSSION

The ACPE accreditation guidelines identify the training of pharmacy students to provide care for pediatric patients as one of the science foundation elements they believe to be essential to the development of pharmacists.¹ The results of a 1997 survey designed to characterize the classroom and experiential content in pediatrics of US colleges and schools of pharmacy found that only 37 (67%) programs included pediatrics in their curriculum.⁶ The mean amount of time allocated to pediatric topics in the curricula at these colleges and schools was 16.7 ± 11.6 hours. Eighteen percent of programs indicated that they offered a separate elective, whereas an additional 36% of programs reported that elective coursework in pediatrics was offered within nonpediatric-focused electives. Ninety-three percent of programs offered an APPE in pediatrics, but only 40% of enrolled students had the opportunity to complete this type of experience prior to graduation. Nearly a decade after this study was conducted, the Pediatric PRN of the ACCP published an opinion paper recommending that the PharmD curricula should foster a core of knowledge, skills, abilities, attitudes, and values necessary for pharmacists to become well-rounded general practitioners who can provide care to a wide variety of patients, including infants and children.² This group provided specific curricular recommendations intended to assist schools in accomplishing this goal. However, current data describing to what extent pediatrics is being taught, what topics are being taught, and how pediatrics is being taught across US PharmD programs have been lacking, and, thus, how program curricula have changed since publication of the ACCP recommendations is unknown. Our study aimed to answer these questions in order to provide guidance to pharmacy programs for self-assessing and, if needed, for modifying their curriculum in pediatrics.

Our study found that nearly all of the responding PharmD programs (94.2%) included pediatrics in their required classroom curriculum, despite 25% of programs

Table 4. Pediatric Topics Taught in Elective Curricula at United States Doctor of Pharmacy Programs (n=45)

	Programs,		Programs,		Programs,	
	Recommended Topics ^a	No. (%)	Strongly Encouraged Topics ^b	No. (%)	Additional Topics ^c	No. (%)
	Pediatric infectious diseases	38 (84.4)	Neonatology (eg, apnea of prematurity, chronic lung disease, sepsis, respiratory distress syndrome, nutrition, enteral drug absorption)	38 (84.4)	Pain management	25 (55.6)
	Meningitis	28 (62.2)	Pediatric cardiology (eg, structural heart defects, cardiomyopathy, cardiac arrhythmias)	31 (68.9)	Fever	23 (51.1)
	Lower respiratory tract infection (community acquired pneumonia)	26 (57.8)	Cystic fibrosis	24 (53.3)	Endocrinology (eg, diabetes)	22 (48.9)
	Upper respiratory tract infection	26 (57.8)	Gastroenterology (eg, gastroesophageal reflux, short-gut syndrome)	24 (53.3)	Pulmonology (eg, asthma)	22 (48.9)
	Sepsis	25 (55.6)	Hematology (eg, thalassemia, sickle cell disease)	22 (48.9)	Other	5 (11.1) ^d
	Urinary tract infection	25 (55.6)	Psychiatry (eg, attention deficit disorder)	22 (48.9)		
	Lower respiratory tract infection (bronchiolitis)	22 (48.9)	Nephrology (eg, hypertension, nephrotic syndrome, vesicoureteral reflux)	19 (42.2)		
	Acute otitis media	21 (46.7)	Neurology (eg, epilepsy, migraine, cerebral palsy)	18 (40.0)		
	Effects of renal and hepatic maturation on drug metabolism and elimination	32 (71.1)	Oncology	18 (40.0)		
	Growth and development (eg, embryonic and fetal development, failure to thrive, growth charts, obesity)	32 (71.1)	Drugs commonly used in pregnancy and lactation	15 (33.3)		
	Nutrition (eg, with infant formulas, vitamins, supplements)	31 (68.9)	Human immunodeficiency virus and acquired immunodeficiency syndrome	13 (28.9)		
	Assessment of renal function in pediatric patients	30 (66.7)	Substance abuse in adolescence	10 (22.2)		
	Fluid and electrolyte therapy (eg, for dehydration)	30 (66.7)	Immunology (eg, juvenile rheumatoid arthritis, lupus, food allergies, anaphylaxis)	8 (17.8)		
	Therapeutic drug monitoring (eg, of aminoglycosides, vancomycin, antiepileptics)	30 (66.7)				
	Selection of drug doses and dosing forms for pediatric patients	29 (64.4)				
	Strategies to reduce medication errors in pediatric patients	29 (64.4)				
	Immunizations	26 (57.8)				
	Appropriate sources of drug information for pediatric patients	25 (55.6)				
	and policies for off-label drug use					
	Safety issues about neonatal exposure to excipients in pharmaceutical products	21 (46.7)				
	Clinical toxicology	18 (40.0)				

(Continued)

Table 4. (Continued)

	Programs,		Programs,		Programs,	
	Recommended Topics ^a	No. (%)	Strongly Encouraged Topics ^b	No. (%)	Additional Topics ^c	No. (%)
Pediatric physical assessment		18 (40.0)				
Effective communication techniques for parents and children		13 (28.9)				

^aAmerican College of Clinical Pharmacy Pediatric Practice and Research Network (ACCP Pediatric PRN) 2005 recommended pediatric subject areas.

^bACCP Pediatric PRN 2005 strongly encouraged pediatric subject areas.

^cPediatric subject areas omitted from the ACCP Pediatric PRN 2005 opinion paper.

^dPediatric research (n=3), over-the-counter management of common pediatric disease states (diaper dermatitis) (n=2), pharmacokinetics (n=1), renal transplantation (n=1), pediatric code blue (n=1), metabolic disorders (n=1), Kawasaki Disease (n=1), juvenile dermatomyositis (n=1), ethical issues in pediatric care (n=2), pulmonary hypertension (n=1), pediatric dermatology (n=1).

not employing a full-time faculty member specializing in pediatric pharmacy practice. This finding indicates a considerable increase compared with the 1997 survey, which estimated that only two-thirds of PharmD programs taught pediatrics in their required classroom curriculum.⁶ The vast majority of programs, therefore, appear to be in compliance with ACPE accreditation guidelines that recommend pharmacy students be trained to provide care for special populations, including pediatrics.¹ Our study also revealed that the time dedicated to pediatrics in the required curriculum has increased by 31% since 1997, with PharmD programs now providing an average of 22 contact hours of pediatric pharmacy education.⁶ Despite this increase, the majority of PharmD programs included in this survey still do not meet the 25 contact-hour expectation outlined in the ACCP Pediatric PRN opinion paper.² However, given that pediatric topics may be dispersed among courses and lecture classes, making it difficult to calculate/report the precise number of contact hours, these data are only approximations. Further, the contact hour recommendation published by ACCP should be viewed only as a guide for PharmD programs to use when designing/modifying their pediatric curricula.

The ACCP Pediatric PRN recommended that all PharmD programs offer an elective course in pediatrics. In line with this recommendation, a joint opinion paper from the ACCP Pediatric PRN and Pediatric Pharmacy Advocacy Group (PPAG) published in 2013 indicated the importance of offering an elective course in pediatric pharmacotherapy for students interested in pediatrics in order to help develop clinical pharmacists in this specialty area of practice.⁷ Our study found that nearly two-thirds of responding programs offered a standalone elective course in pediatrics, representing a 43% increase since 1997.⁶ Three-quarters of these programs met the goal of 16-32 hours recommended in the ACCP Pediatric PRN opinion paper,² but the portion of programs meeting this recommendation may actually be higher, based on the following: 4 programs appear to have misinterpreted the survey instrument question as asking for credit hours rather than contact hours (2 indicated that their elective course consisted of only 2 contact hours and 2 indicated that their elective course consisted of only 3 contact hours). Among programs that did not offer a standalone elective course, more than half taught pediatrics in other elective courses, the extent of which is unknown. Of the 16 programs that did not have a full-time faculty member specializing in pediatrics, 9 offered a standalone elective course in pediatrics, demonstrating that programs can find a way to offer an elective course even without a full-time faculty member specializing in pediatrics.

Table 5. Pediatric Experiential Education Offered by United States Doctor of Pharmacy Programs

IPPEs	Programs (n=41), No. (%)	APPEs	Programs (n=72), No. (%)
Inpatient general pediatrics	30 (73.2)	Inpatient general pediatrics	63 (87.5)
Distributional	16 (39.0)	Neonatal intensive care	48 (66.7)
Ambulatory general pediatrics	10 (24.4)	Pediatric intensive care	48 (66.7)
Pediatric hematology/oncology	6 (14.6)	Pediatric hematology/oncology	29 (40.3)
Neonatal intensive care	5 (12.2)	Ambulatory general pediatrics	19 (26.4)
Pediatric intensive care	5 (12.2)	Distributional	17 (23.6)
Pediatric infectious diseases	2 (4.9)	Pediatric infectious diseases	11 (15.3)
Other	6 (14.6) ^a	Other	10 (13.9) ^b

Abbreviations: IPPEs=introductory pharmacy practice experiences; APPEs=advanced pharmacy practice experiences.

^aAdolescent medicine (n=1), immunization clinics (n=1), student-run free medical clinic (n=1), service learning (n=2), asthma and allergy ambulatory care (n=1), pediatric nephrology and solid organ transplantation (n=1).

^bManagement (n=1), medication safety (n=1), emergency department (n=1), pediatric nephrology and solid organ transplantation (n=1), pediatric pulmonology (n=1), asthma and allergy ambulatory care (n=1), pediatric complicated care (n=1), pediatric pulmonology clinic (n=1), pediatric surgery (n=1), rehabilitation (n=1), adolescent medicine (n=1), special needs patients (n=1).

The ACCP Pediatric PRN opinion paper recommended 15 topics in pediatrics. After grouping the pediatric infectious disease topics assessed in our survey into a single topic, only 3 of the ACCP Pediatric PRN recommended pediatric topics were not included in the majority of PharmD program required curricula: clinical toxicology; pediatric physical assessment; and effective communication for parents and children.² While the topics taught by the majority of programs have not changed much since 1997, our survey found that there has been an increase in the number of PharmD programs covering the following ACCP Pediatric PRN recommended topics: growth and development; nutrition; fluid and electrolyte therapy; selection of drug doses and dosing forms for pediatric patients; and, appropriate sources of drug information for pediatric patients and policies for off-label drug use.^{2,6} The quality of instruction should also be considered of utmost importance. In our study, we observed that both lecture and case-based instruction/learning were commonly used to teach pediatrics. However, lecture was identified as the most commonly used method, despite evidence suggesting that active-learning strategies, such as case-based learning, may be a more effective way to teach pharmacy students.⁸

Experiential education is a valuable aspect of pharmacy education. The ACCP Pediatric PRN recommended that all students should have the opportunity to complete at least 1 practice experience in a pediatric setting.² Correspondingly, the ACCP Pediatric PRN and PPAG recommended that all core topics be reinforced during practice experiences in pediatrics.⁷ The results of our survey indicate an increase in the percentage of programs offering at least 1 APPE specializing in pediatrics from 93% to 97% since 1997.⁶ Inpatient APPEs were found to be the predominant training experience for pediatrics, similar to what

was reported in 1997. Ambulatory care APPEs remain essentially untapped, with only one-fourth of PharmD programs offering an experience in this setting. As the focus of healthcare shifts from the inpatient setting to the outpatient setting, programs may need to consider expanding the training of students in pediatric ambulatory care. The mean number of students completing an APPE in pediatrics has almost doubled since 1997, increasing from 12 students per program in 1997 to 23 students in 2013.⁶ However, the mean class size in our study population of 126 students indicates that less than 20% of students engage in an APPE in pediatrics prior to graduation, which is half of what was reported in 1997.⁶ Therefore, colleges and schools must explore avenues to expand experiential training opportunities in pediatrics in order to meet the ACCP Pediatric PRN recommendations.

A limitation to our study was the survey response rate of 67.2%. Although it exceeds 60% and is, therefore, acceptable, the response rate did not attain our goal of 80%.⁹ Therefore, the data presented herein cannot be considered representative of all US PharmD programs. However, the distribution of responses and nonresponses from accredited and candidate-status programs, public and private institutions, and geographic region, is similar to the demographics of the sample size as a whole, which should have minimized the risk for nonresponse bias in this study.

CONCLUSION

Almost all of the responding US PharmD programs included pediatrics in their required classroom curricula. The mean number of contact hours dedicated to pediatrics was approximately 22 hours, with the majority of topics being covered during the third year of the PharmD program. The topics covered in the required curricula somewhat aligned with ACCP Pediatric PRN recommendations.

Slightly more than half of responding PharmD programs offered a standalone elective course in pediatrics, with the mean number of contact hours meeting ACCP recommendations. The majority of responding PharmD programs offered an IPPE and almost all offered an APPE in pediatrics. However, the quantity of available APPEs appears to be inadequate to meet the needs of all graduating students. Continued expansion of pediatric-focused classroom and experiential curricula across US PharmD programs is therefore recommended to ensure that the next generation of pharmacists is able to effectively care for this special population.

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