INSTRUCTIONAL DESIGN AND ASSESSMENT

An Introductory Pharmacy Practice Experience Emphasizing Student-Administered Vaccinations

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Objective. To introduce a requirement for second-professional year (P2) and third-professional year (P3) students to administer vaccinations to adults in community pharmacy-based immunization clinics.

Design. Second-professional year students were trained to administer influenza, pneumococcal, and other vaccinations to adults following the American Pharmacists Association's standards. All P2 students in fall 2004 and all P2 and P3 students in fall 2005 were assigned to 2 community pharmacy-based immunization clinics in the metropolitan Denver area under the supervision of immunization-certified staff pharmacists. An evaluation of the experience was conducted using retrospective preceptor and student-based survey data.

Assessment. In 2004 and 2005, the students administered approximately 5,000 (30-50 immunizations per student) and 15,000 (60-70 per student) immunizations, respectively. Students and preceptors agreed that the requirement to administer vaccinations was an appropriate activity for students and that it increased the students' self-confidence. When asked to rate the value of the students' work administering adult immunizations in the fall 2004 semester, the mean score given by the P2 students' immunization-certified preceptors was 9.2 on a 10-point Likert scale (1 = no value and 10 = great value).

Conclusion. Consistent with accreditation standards for students to have direct patient care responsibilities in introductory pharmacy practice experience courses, a requirement for P2 and P3 students to administer vaccines to adult patients in community pharmacies was successfully introduced.

Keywords: immunization, vaccination, pharmacy student, introductory pharmacy practice experience, accreditation standards

INTRODUCTION

The University of Colorado at Denver and Health Sciences Center School of Pharmacy (UCDHSC-SOP) implemented its first professional doctor of pharmacy degree program in 1999. In line with Accreditation Council for Pharmacy Education (ACPE) accreditation standards and guidelines¹, 6 introductory pharmacy practice experience (IPPE) courses designed to give each student increasing patient care responsibilities in preparation for advanced pharmacy practice (APPE) training were included in the new curriculum and descriptions of those courses have been published.²⁻⁵ Introductory experiential courses are many students' first exposure to pharmacy

practice and, accordingly, it is crucial that IPPEs incorporate changes in the profession and reflect contemporary pharmacy practice. In 2003, the first community pharmacist-administered adult immunization clinics were offered in Colorado and, as a consequence, the UCDHSC-SOP chose to incorporate adult immunization experiences as part of its IPPE program. This paper describes the incorporation and evaluation of required adult immunization experiences as part of the school's third, fourth, and fifth IPPE courses which emphasize health-promotion and disease-prevention activities in community pharmacy practice and are offered sequentially in the fall and spring semesters of the P2 year and in the fall semester of the P3 year of the PharmD program.⁵

DESIGN

Students are trained to administer influenza, pneumococcal, and other vaccines to adults through the American

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Pharmacists Association's (APhA) Pharmacy-Based Immunization Delivery: A National Certificate Program for Pharmacists. They complete the program's self-study component during the summer prior to the start of the P2 year and the didactic and skills components are taught by the school's full-time faculty members assisted by immunization-certified adjunct faculty members in four 3-hour classes at the start of the fall IPPE course. Students returning to the school for the P3 year repeat the clinical skills component of the APhA course to hone their clinical immunization skills.

The school works with all chain and independent community pharmacies willing to supervise P2 and P3 students in pharmacist-administered adult immunization clinics in the metropolitan Denver area. All P2 and P3 students attend 2 clinics between the first of October and early December and participate for 90 minutes at each clinic under the supervision of an immunization-certified pharmacist. Multiple students (consistent with Colorado State Board of Pharmacy regulations) were assigned to each clinic. No pharmacy in the metropolitan Denver area schedules immunization clinics in the spring semester, but walk-in immunization services are offered year-round and, if the opportunity arises, students are expected to administer adult vaccinations as part of the community pharmacy-based component of the P2 spring IPPE course.⁵

An evaluation of the student-administered vaccination experience was conducted based on retrospective student (classes of 2007 and 2008) and preceptor survey data. Students in the UCDHSC-SOP program are required to complete a course evaluation survey using *Blackboard* at the completion of all IPPE courses and items about immunization were included in the surveys completed by P2 students at the end of the fall 2004, fall 2005, and spring 2005 semesters, and by P3 students at the end of the fall 2005 semester. At the end of the fall semester of their second-professional year, all students in the 2007 and 2008 classes were asked to self-assess their level of confidence in their immunization skills immediately prior to immunizing their first patient in their first clinic and their last patient in their second clinic on a 10-point scale (1 = minimal self-confidence and 10 = maximum self-confidence). Using the same scale, students in the 2007 class were asked at the end of the fall semester of their third-professional year to self-assess their level of self-confidence in their immunization skills immediately prior to immunizing their first patient in their first P2 clinic, their first patient in their first P3 clinic, and their last patient in their second P3 clinic. In addition, using a 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree), the 2 classes were surveyed at the end of

the fall semester of their second-professional year for opinions on the appropriateness of training P2 students to administer adult immunizations and on the appropriateness of requiring P2 students to administer adult immunizations. The same scale was used to survey students in the 2007 class at the end of the fall semester of their third-professional year for opinions on the appropriateness of requiring P3 students to administer adult immunizations. Each P2 student at the completion of his/her fall and spring IPPE courses (third and fourth IPPE courses) and each P3 student at the completion of his/her fall IPPE course (fifth IPPE course) was asked to estimate the number of patients he/she immunized during the semester using the following scale: 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, 91-100 and >100.

All community pharmacy preceptors participating in the fall 2005 IPPE course for P2 students were asked to participate in a retrospective survey of the 6-course IPPE program. The School's interest was to determine preceptors' thoughts and opinions established since 1999 (when the IPPE program began) for curriculum review and planning purposes. The one-time request was made by the school's director of experiential programs as part of the normal yearly summer-time recruitment of IPPE preceptors and the preceptors were informed the survey instrument, which included items related to the immunization experience, would be administered by his/her P2 student at the start of the upcoming fall semester. The preceptors were told that their students would record their responses and transcribe them via the *Blackboard* software computer program to provide the school with collated anonymous data. The students, who were already familiar with the *Blackboard* program from their P1 year, collected and transcribed the data to avoid the necessity of training the preceptors to use *Blackboard*. The survey questions were administered at the start of the semester to avoid confusion (ie, to make sure each preceptor knew the survey did not relate to their new student's performance).

The survey was created by the director of experiential programs (information about its non-immunization aspects will be published separately). All preceptors, regardless of their own immunization certification status, were asked for their opinion about the suitability of requiring P2 students to administer adult immunizations on a 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). Those preceptors who supervised students in immunization clinics in fall 2004 were asked to reflect on and assess the mean level of students' self-confidence immediately prior to immunizing their first and last patient on a 10-point scale where 1 = minimal self-confidence and 10 = maximum self-confidence. In addition, those preceptors were asked to

estimate the number of patients each student immunized during the fall 2004 semester per clinic on the scale 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, 91-100, and >100. They were also asked to rate the mean value (to the preceptor and his/her pharmacy) of the students' work administering vaccinations during the fall 2004 semester on a 10-point Likert scale where 1 = no value and 10 = great value.

Numerical data were analyzed by descriptive statistics and 2-tailed, unpaired *t* tests assuming equal variances. Unpaired, rather than paired, *t* tests were used to analyze pre/post data because the responses to the survey questions by each student or preceptor were not linked to each other in the data handling process. Statistical significance was set at *P* = 0.05.

ASSESSMENT

The number of adult immunizations administered by students under the supervision of on-site immunization-certified pharmacists is the primary evidence of student achievement (Table 1). Immunization certification for P2 students was implemented in fall 2004 and students and preceptors estimated that the class immunized approximately 5000 patients that semester (30-50 patients per student). The students' estimate was larger than the preceptors' estimate, but regardless of which is more accurate, the estimates provide evidence that the students immunized large numbers of patients. The estimated (by students) total number of patients immunized in fall 2005 by P2 and P3 students was approximately 15,000 (60-70 patients per student).

The evidence of student achievement provided by the number of student-administered immunizations was sup-

ported by other course evaluation data (Tables 2 and 3). Both student and preceptor-based assessments of students' self-confidence in administering immunizations showed large increases between the time students immunized their first and last patient (Table 2). The data also showed that the self-confidence the class of 2007 gained during fall 2004 (their P2 year) carried over to the start of the 2005 fall semester (their P3 year), and that information provided by the students was consistent. The 2007 class was asked at 2 time points (end of the fall 2004 and fall 2005 semesters) to reflect back and rate their level of self-confidence immediately prior to immunizing their first patient in their first-ever vaccination clinic and the 2 estimates were consistent (no statistically significant difference). The preceptors' opinion of the students' self-confidence immediately prior to immunizing their first patient was higher than the students' own opinion, but the preceptor-based data reflects 2 populations of students. Each student was assigned to 2 immunization clinics, each with a different preceptor, and accordingly, some students were undertaking their second clinic when supervised by some preceptors for the first time.

The large majority of students and preceptors strongly agreed or agreed that certifying P2 students to administer adult immunizations and requiring students to participate in pharmacist-administered immunization clinics were appropriate activities (Table 3). In addition, the preceptors valued the work performed by the students. The mean score given by 49 immunization clinic preceptors when asked to rate the value of the P2 students' work administering adult immunizations in fall 2004 on a 10-point Likert scale (1 = no value and 10 = great value) was 9.2 ± 0.2 (standard error).

Table 1. Estimates of the Numbers of Patients Immunized by Second- and Third-Year Pharmacy Students Enrolled in Introductory Pharmacy Practice Experiences

Semester	Class of 2007 PharmD Students (n = 121-125)*		Class of 2008 PharmD Students (n = 123)		Preceptor (n = 50)	
	Min	Max	Min	Max	Min	Max
Fall 2004						
Total patients immunized	5706	6660			3509	4598
Mean no. patients/student	47	55			29	38
Spring 2005						
Total patients immunized	2759	3200				
Mean no. patients/student	23	27				
Fall 2005						
Total patients immunized	7963	8800	8124	8970		
Mean no. patients/student	64	70	66	72		

*Number of students in the 2007 class varied between the fall 2004, fall 2005, and spring 2005 semesters

Min/Max = minimum and maximum estimates based on the scale used

Table 2. Student and Preceptor Estimates of Pharmacy Students' Self-Confidence in Administering Adult Immunizations*

Time Point	Class of 2007 (n = 121-125) [†]		Class of 2008 (n = 123)	Preceptor (n = 50)
	Fall 2004, Mean (SE)	Fall 2005, Mean (SE)	Fall 2005, Mean (SE)	Mean (SE)
P2 students just before giving first immunization.	4.6 (0.3) ^a	5.1 (0.3) ^c	4.3 (0.2) ^f	6.2 (0.4) ^h
P2 students just before giving last immunization.	8.4 (0.2) ^b		8.9 (0.1) ^g	8.6 (0.2) ⁱ
P3 students just before giving first immunization in P3 year.		8.0 (0.2) ^d		
P3 students just before giving last immunization in P3 year.		8.8 (0.2) ^e		

n = number of students per class or number of preceptors

*Self-confidence assessed on a 10-point Likert scale (1 = minimum self-confidence and 10 = maximum self-confidence)

[†]Number of students in the 2007 class varied between the fall 2004, 2005 and spring 2005 semesters

The following comparisons are statistically significant: a vs b ($P < 0.00001$), c vs d ($P < 0.00001$), d vs e ($P = 0.0004$), f vs g ($P < 0.00001$) and h vs i ($P < 0.00001$). The comparison of a to c, two ratings 12 months apart by the class of 2007 of their self-confidence prior to administering their first ever immunization, was not statistically significant ($P = 0.18$)

DISCUSSION

The number of community pharmacists in the United States administering adult immunizations is increasing⁶ and there is evidence that pharmacy students can successfully participate in initiatives to improve vaccination rates,⁷ but there is little published work on the ability of pharmacy students to administer vaccinations. An abstract has been published describing one pharmacy school's experience using its students to immunize faculty members and incoming students.⁸ Another study reported that vaccination administration skills are widely taught in American pharmacy schools but that opportunities to utilize those skills are limited.⁹

This paper demonstrates that pharmacy students can be successfully trained to immunize large numbers of patients in community pharmacy-based clinics and, furthermore, that pharmacists and pharmacy students are

strongly in favor of using students to administer adult vaccinations. This study provides evidence that experiences can be designed to meet the ACPE accreditation requirement for students in IPPE courses to be involved in actual practice experiences and assume direct patient care responsibilities.¹ It also provides evidence that IPPE courses can be designed which provide learning opportunities for students to build self-confidence and in which the activities performed by students are viewed as highly valuable by preceptors. Historically, students in experiential training have been thought to distract their preceptors and interfere with normal pharmacy operations¹⁰ but the preceptors were appreciative of the students' work in these courses. The preceptors made requests to the UCDHSC-SOP for additional students to participate in vaccination clinics (demand for students outstripped supply). Anecdotal reports indicated that many students were allowed

Table 3. Preceptors' and Students' Opinions on Student Participation in Adult Vaccination Clinics

		Percentage of Respondents				
	Class (n)*	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Preceptors' opinion						
The requirement to administer adult immunizations is an appropriate activity for P2 students.	(105)	40	45	6	7	0
Students' opinions						
The APhA immunization training program is an appropriate activity for P2 students.	2007 (121)	41	38	12	3	6
	2008 (123)	46	48	5	0	1
The requirement to administer adult immunizations is an appropriate activity for P2 students.	2007 (121)	44	32	13	4	7
	2008 (123)	45	45	9	0	1
The requirement to administer adult immunizations is an appropriate activity for P3 students.	2007 (125)	42	38	15	2	3

*The number of students in the 2007 class varied between the fall 2004, fall 2005, and spring 2005 semesters

and/or encouraged to work more than the required two 90-minute sessions per semester and that the students were instrumental in dealing with long patient queues. The students' and preceptors' interest in immunization programs is also indicated by the number of immunizations administered in the spring 2005 IPPE course even though it was an optional activity in that course.

The UCDHSC-SOP's immunization experience challenges the thinking that students acquire competency slowly over the duration of a 4-year program and that the competency expected of a licensed pharmacist is only achieved as the fourth-year curriculum is completed.^{10,11} The students were required to complete the same immunization certification program used to train licensed pharmacists and, though not measured directly, the findings imply that P2 and P3 students achieved the same level of competency expected of a licensed pharmacist. Measured by the estimates of self-confidence, the number of vaccinations administered, and the value the preceptors placed on the students' work, the results demonstrate that competency to administer vaccines was gained quickly and maintained over time. The 2006 ACPE accreditation standards and guidelines state that "the college or school's professional degree program curriculum must prepare graduates with the professional competencies to enter pharmacy practice in any setting to ensure optimal medication therapy outcomes and patient safety. . . ."¹ Four years is a short time to achieve that goal and, if it is to be achieved, it is important to give significant patient care responsibilities to students as early and as often as possible.

It was expected that the 2007 class would immunize less patients in the spring 2005 semester than in the fall 2004 semester but, nonetheless, the spring 2005 estimate is relatively large and may reflect the fall 2004 shortage of influenza vaccine. Influenza vaccine in Denver in fall 2004 was reserved for high-risk patients and vaccine for other patients only became available in the spring semester. In addition, student immunization experiences in the fall 2004 semester were restricted to 2 immunization clinics, whereas the spring 2005 IPPE course offered each student 8 community pharmacy-based opportunities to immunize walk-in patients.⁵ The larger estimate of the number of patients immunized per student in the fall 2005 semester, in comparison to the fall 2004 semester, provides further evidence that the fall 2004 vaccine shortage influenced the number of student-administered vaccinations in 2004. However, it is also possible that the preceptors gained confidence in the students' performance in 2004 and were prepared to give them more responsibility for administering vaccines in 2005.

The primary limitation of this study is the retrospective nature of the evaluation. Information was collected

from the students as part of standard end-of-semester reflective course assessments and information from preceptors about student participation in the fall 2004 immunization experience was collected approximately 9 months after the fact (at the start of the fall 2005 semester). Students and preceptors could have been asked to record student-specific data in real time (eg, number of immunizations administered per student) but that would have interfered with (slowed) patient care activities. The immunization experience was established as an educational opportunity for students rather than as a controlled research study. Each clinic served large numbers of patients with multiple pharmacy students switching between administrative and direct patient care activities for various lengths of time alongside similarly engaged immunization-certified licensed pharmacists. Accordingly, while the pharmacies collected precise information on the total number of patients vaccinated, the precise number immunized by each student was not determined; thus, the estimates of numbers of student-administered vaccinations should be interpreted with caution. Nonetheless, the relative agreement between the student and preceptor-based data suggests the estimates are reasonable. Other limitations of the study include the limited insight provided by the evaluation into student learning. For example, the effect of the immunization experience on the students' sense of professionalism and their transition from dependent to independent learners¹² was not measured, and further study is needed to assess those issues.

CONCLUSION

A requirement for pharmacy students to participate in adult immunization programs was successfully introduced into second- and third-professional-year IPPE courses. The students were trained to administer vaccinations by the same APhA certification program used to train licensed pharmacists. The students gained self-confidence and collectively administered approximately 5,000 and 15,000 influenza, pneumococcal, and other vaccines to adults in community pharmacies in fall 2004 and fall 2005, respectively. The requirement was well received by the students and was supported by the local practice community. This study demonstrates that introductory pharmacy practice experiences can be designed that allow students to undertake activities rated highly valuable by their preceptors and which meet ACPE accreditation standards for student involvement in direct patient care activities.

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