INSTRUCTIONAL DESIGN AND ASSESSMENT

Student Knowledge, Skills, and Self-Efficacy Gains After Completing an Advanced Pharmacy Practice Experience in Geriatrics

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Objective. To assess changes in pharmacy students' knowledge, skills, and self-efficacy after completing an advanced pharmacy practice experience (APPE) in geriatrics.

Design. During the 2013-2014 academic year, 30 Virginia Commonwealth University (VCU) School of Pharmacy students were required to complete a 5-week Geriatrics APPE at Plaza Professional Pharmacy in Richmond, Virginia. All students completed a 25-point knowledge-based pre- and post-assessment to measure students' self-efficacy. The average time required to accurately fill one unit dose prescription card before and after completing the APPE was also evaluated.

Assessment. Students' average score on the knowledge component improved significantly from 54% to 88% after completing the APPE. The average time required to fill one prescription decreased significantly from 4.0 minutes to 2.5 minutes. Students reported an increase in self-efficacy in the following areas: communication, immunizations, geriatrics-specific pharmacotherapy knowledge, and the ability to fill and check monthly unit dose prescription cards.

Conclusion. Requiring fourth-year pharmacy students to complete a geriatrics APPE as a capstone experience to the integrated geriatrics content covered in the first through third years of the doctor of pharmacy (PharmD) curriculum provides an important opportunity to improve students' knowledge, skills, and self-efficacy in providing care to older adults.

Keywords: geriatrics; advanced pharmacy practice experience; experiential education; self-efficacy

INTRODUCTION

The Institute of Medicine (IOM) released a report in 2008 entitled *Retooling for an Aging America: Building the Health Care Workforce* that addressed the lack of health care providers to meet the needs of an aging US population.¹ The number of older adults (aged 65 years and older) is expected to double from 2010 to 2050, reaching nearly 89 million.² Furthermore, older adults rely heavily on health care services and consume a larger proportion of prescription medications than the rest of the population.¹ In 2007-2008, more than 76% of Americans 60 years of age and older used at least 2 prescription drugs in the past month, while 37% used 5 or more.³ The IOM report offers suggestions to help mitigate this problem including boosting recruitment and retention of geriatrics specialists and enhancing geriatrics competence through substantial improvements in educational curricula and

training programs.¹ Despite these suggestions, only 15 out of 912 postgraduate year two (PGY2) residencies are geriatrics-focused and accredited by the American Society of Health-System Pharmacists. Also, less than 1% of US pharmacists specialize in geriatrics.^{1,4}

The 2016 Accreditation Council for Pharmacy Education (ACPE) Standards and Guidelines do not require geriatrics as part of the doctor of pharmacy (PharmD) curriculum.⁵ The ACPE states only that students be exposed to "diverse populations" on Advanced Pharmacy Practice Experiences (APPEs) and that the pre-APPE curriculum should provide foundational knowledge and skills that allow students to care for patients "across the lifespan."⁵ Additionally, the 2013 Center for the Advancement of Pharmacy Education (CAPE) Educational Outcomes recognize the need for students to adequately assess the health needs of a specific population, but there is no explicit mention of geriatrics.⁶ Due in part to the lack of a geriatrics requirement in the classroom or experiential curriculum for the PharmD degree, the American Society of Consultant Pharmacists (ASCP) has published a new

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Geriatric Pharmacy Curriculum Guide with recommendations to prepare pharmacy students to care for older adults.⁷

Because the ACPE does not require institutions to include geriatrics in the PharmD curriculum, schools of pharmacy have been slow to incorporate geriatrics-specific content into their programs. While the majority of PharmD programs offer elective or required geriatrics-focused didactic content, a 2012 survey of 50 schools of pharmacy found that only 20% required a geriatrics-focused APPE.⁸ These results were not significantly different than those from similar surveys conducted in 2005 and 1985, suggesting that geriatrics-focused education has not continued to expand with the aging population.⁸

The failure to continue to develop geriatrics content in the PharmD curriculum has resulted in pharmacy students being undertrained in this area.⁹ A study evaluating pharmacy, nursing, and physician assistant students found that only 65% agreed or strongly agreed that the gerontological content throughout their education adequately prepared them to care for older adults, which suggests a lack of self-efficacy in this area among these healthcare students.⁹ (Self-efficacy is similar to self-confidence in that it refers to beliefs about one's proficiencies; however, self-efficacy is generalizable to new situations and experiences.¹⁰) Despite schools providing geriatric elective courses, there is still room for improvement in both knowledge and self-efficacy among pharmacy students in this area.

There are no studies evaluating the effect of completing a required geriatrics-focused APPE on pharmacy students' knowledge and self-efficacy in geriatrics. The goal of this study was to assess the importance of integrating geriatrics education into the pharmacy curricula to meet the needs of this increasing patient population. The primary objective of this study was to measure changes in pharmacy students' knowledge, skills, and self-efficacy in their ability to achieve competencies related to their geriatrics APPE and practice.

DESIGN

At Virginia Commonwealth University (VCU) School of Pharmacy, geriatrics-focused content is integrated throughout the instructional curriculum. As a capstone experience, students were required to complete a 5-week practice experience in geriatrics as 1 of their 8 required APPEs during their fourth year. The APPE consisted of 200 hours of experience in a geriatrics-focused care setting. The sites included community pharmacies, specialty clinics, rehabilitation centers, hospitals, skilled nursing facilities, home-based consult services, and assisted living facilities. The learning objectives for the Geriatrics APPE were for students to be able to:

Apply principles of pharmacotherapy to patient care; compare and contrast pharmacotherapy principles in older and middle-aged adults; identify, resolve, and prevent medication-related problems, and manage medication therapy to ensure that medications are appropriate, safe, effective, and used correctly; communicate effectively with patients and caregivers to elicit candid health information; provide patient education that is culturally sensitive and at the appropriate level of health literacy; communicate relevant, concise, comprehensive, and timely information through oral and written communication in a clear manner using appropriate terminology and vocabulary for healthcare professionals; apply appropriate drug reference sources (electronic and printed) to retrieve drug-related information to identify, resolve, and prevent drug-related problems; discuss the pathophysiology, signs, symptoms, and treatment options for common diseases seen in older adults; describe the clinical pharmacology of commonly used medications in older adults; and demonstrate communications, attitude, behaviors, and appearance as articulated in the Attributes of Professionalism policy.

One of the sites where students could complete this required APPE was at Plaza Professional Pharmacy, located within Brookdale Imperial Plaza, a large retirement community in Richmond, Virginia. With about 900 independent living (IL) residents and 150 assisted living (AL) residents, it is one of the largest retirement communities in Virginia. The average age of IL and AL residents was 86 years. During their APPE, students learned to communicate with older adults, completed medication reviews for IL and AL residents, screened and provided age appropriate immunizations, bubble packed and ensured AL residents received appropriate medications, and provided various health screenings and monitoring. A sample weekly calendar is provided in Appendix 1.

From the learning objectives determined by VCU School of Pharmacy for the Geriatrics APPE and site activities and expectations, the faculty at VCU in collaboration with the pharmacy preceptors at Plaza Professional Pharmacy created a pre- and post-assessment instrument. The instrument included a 25-point knowledge-based quiz and a survey to ascertain students' self-efficacy in the following areas: communication, immunizations, geriatrics-specific pharmacotherapy knowledge, and the ability to fill and check monthly unit dose prescription cards. Table 1 lists knowledge domains assessed according to ASCP, ACPE, CAPE outcomes, and Bloom's Taxonomy, and the APPE learning objectives that correlate with each question from the assessment.^{5-7,11} The average time required to accurately fill one unit dose prescription card before and

Table 1. Domains of Knowledge Assessed in a Quiz Administered to Fourth-Year Pharmacy Students Prior to and After Completing an Advanced Pharmacy Practice Experience in Geriatric Care

Item on Assessment	ASCP Curriculum Guide ⁷	ACPE ⁵	CAPE Outcomes ⁶	Bloom's Taxonomy ¹¹	APPE Learning Objective
Name 4 Alzheimer's disease medications and their mechanisms of action.	II.C.4	2.1	1.1.1, 1.1.3	1.1.2, 1.2.3	1, 8, 9
State the creatinine clearance at which certain medications need renal dose adjustments or are contraindicated.	II.D.4, II.D.6, II.C.7	2.1	1.1.1	1.1.2, 1.2.1, 1.2.3	1, 3, 8, 9
Recall how often residents in Assisted Living Facilities in Virginia should have their medications reviewed by a healthcare provider.	II.D.2	1.1	2.4.1, 2.4.3	1.1.2, 1.2.1	1, 2, 8
Construct a chart with 4 vaccinations including dose and route of administration for each immunization.	I.F.1	3.3	2.3.1	3.0	1, 8, 9
List 5 medication classes that are associated with falls.	II.C.6, I.F.3	2.1	1.1.1, 2.4.1	1.1.2, 1.2.3	1, 2, 3, 8, 9
Rewrite the directions that are incorrect for the following medications.	II.D.5	2.1	1.1.1	5.2, 6.2	1, 3, 9
List monitoring parameters for the following medications.	II.E.1	2.1	2.1.6	1.1.2, 1.2.1, 1.2.2, 1.2.4	1, 3, 8, 9
Select an A1c goal for a patient from a case and relate that A1c goal to a blood glucose level.	II.C.7, II.D.1, III.A.4	2.1	3.1.2	3.0	1, 8
Identify Beer's List medications from a patient case.	II.C.6, II.D.2, III.A.1	1.1, 2.1	1.1.5	1.1.1, 1.1.2, 1.2.3, 1.2.4	1, 2, 3, 8, 9
Recognize medications in a patient case that should not be used in regards to renal function.	II.C.6, II.C.7, II.D.4, II.D.6	2.1	1.1.1, 1.1.4	1.1.2, 1.2.1, 1.2.3, 1.2.4	1, 3, 8, 9

(Continued)

Table 1. (Continued)

Item on Assessment	ASCP Curriculum Guide ⁷	ACPE ⁵	CAPE Outcomes ⁶	Bloom's Taxonomy ¹¹	APPE Learning Objective
Recognize 2 major drug-drug interactions in a patient case.	II.C.6, II.D.6	2.1	1.1.1	1.1.2, 1.2.3, 1.24	1, 3, 8, 9
Identify a missing medication for an indication from a patient case.	II.C.6, II.D.6	2.1	1.1.1, 1.1.4	1.1.2, 1.2.1, 1.2.2, 1.2.3, 1.24	1, 3, 8, 9
Post-assessment Medication Review	I.C.7, I.F.1, II.C.6, II.E.1, II.E.2	3.1, 3.3	1.1.4, 2.1.4	3.0	1, 2, 3, 6, 8, 9
Self-Efficacy Survey	I.C.14, I.C.15, I.D.4, III.C.3	4.1	4.1.1, 4.1.6, 4.1.9	2.2	1, 2, 4, 5, 6, 7, 10
Practical-based Assessment	I.C.7, I.F.1, II.C.6, II.E.1, II.E.2	3.1, 3.3	1.1.4, 2.1.2, 2.1.3, 2.1.4, 3.1.1, 3.1.3	5.2, 6.1, 6.2	1, 3, 6, 8, 9

Abbreviations: ASCP = American Society of Consultant Pharmacists; ACPE = Accreditation Council for Pharmacy Education; CAPE = Center for the Advancement of Pharmacy Education

after completing the APPE also was evaluated. On the post-assessment, students were also required to conduct a medication review for an AL patient using a provided case, which was reviewed but not scored by the faculty member grading the assessments.

The pre-assessment was administered to students on the first day of the APPE after students completed a site orientation. The assessment included open-ended, written items. The students did not have to finish the pre-assessment in a designated amount of time, although the time it took to fill the monthly unit dose prescription cards for a single patient was recorded. The students were each randomly given a different patient whose prescription for a medication was due to be filled in the monthly cycle. The number of prescriptions each student filled varied because each student was assigned an actual patient's prescription list. The students had to complete the assessment without using outside resources. The post-assessment was conducted during the last week of the APPE. All of the assessments were graded by the same VCU faculty member for consistency. The preceptors at Imperial Plaza Pharmacy hypothesized that there would be learning and self-efficacy gains after completion of the APPE.

Consent from students to use their de-identified assessments was obtained. The Institutional Review Board of VCU approved this study as exempt research.

EVALUATION AND ASSESSMENT

The overall scores of the pre- and post-APPE knowledge assessments are reported as means and standard deviations (SDs) in Table 2. For continuous variables, the Student *t* test was used to evaluate the mean difference between 2 groups, while ANOVA was used when there were more than 2 groups. All statistical analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, NC). A *p*-value <0.05 was considered significant. Improvements in self-efficacy were described by increase, decrease, or no change. An increase in self-efficacy represents that the student reported at least one self-efficacy level higher on the post-APPE survey. For example, students who reported that they were "not very confident" on the pre-APPE survey but reported being "somewhat confident" on the post-APPE survey were considered to have had an increase in self-efficacy for that area. The opposite was true for responses categorized as a decrease in self-efficacy. If a student reported the same level of self-efficacy on both the pre- and post-APPE survey, then no change in self-efficacy occurred.

Thirty students from VCU School of Pharmacy completed the pre- and post-assessment during the fourth year

Table 2. Comparison of Students' Knowledge and Prescription Processing Skills Before and After Completing an Advanced Pharmacy Practice Experience in Geriatrics (N=30)

Factor	Pre-assessment, Mean (SD)	Post-assessment, Mean (SD)	p-Value ^a
Student knowledge	13.4 (3.1)	22 (1.6)	<.001
Time to fill prescription (min)	4.0 (1.0)	2.5 (0.8)	<.001
Number of errors/prescription	0.1 (0.1)	0.1 (0.1)	.48

^aPaired *t*-tests were used to evaluate the difference in mean between pre- and post-assessments with a 0.05 level of significance

of their pharmacy program. The number of students that completed the geriatrics APPE during each rotation block is reported in Table 3. The overall score of students' knowledge before the geriatrics APPE was 13.4 ± 3.1 , increasing to 22.0 ± 1.6 after the APPE (Table 2).

The knowledge scores of students who completed the geriatrics APPE during one of the first 3 rotation blocks (n=15) was compared to the scores (n=15) of students who completed the APPE during rotation blocks 4-9 to determine if the timing of the APPE affected student knowledge gains. The average score of students who completed the APPE during one of the first 3 rotation blocks was 13.5 on the pre-assessment, increasing to 22.2 on the post-assessment. The average scores for students who completed the APPE during rotation blocks 4-9 were 13.2 and 21.8 on the pre- and post-assessment, respectively. The difference in scores between students who completed the APPE in during rotation blocks 1-3 and those who completed the APPE during rotation blocks 4-9 was not significant.

Students spent an average of 4.0 ± 1.0 minutes at the beginning of the APPE filling 1 prescription for 1 patient. This time decreased to 2.5 ± 0.8 after completing the APPE. The average error rate per prescription was 0.1 (0.1) at the start of the APPE and 0.1 (0.1) at the end of the APPE (not significantly different). Both mean differences in overall students' knowledge scores and the time to fill a prescription were significant (<0.001).

Table 4 explains the students' self-efficacy pre- and post-APPE survey in 4 different skills. Almost all of the students (96.6%) reported self-efficacy increases in the area of gaining knowledge in geriatrics pharmacotherapy and completing a medication review. The majority (86.6%) of the students reported increased self-efficacy in their ability to administer immunizations to older adults, while 13.3% reported decreased self-efficacy. Also, 76.6% of the students reported increased self-efficacy in their ability to fill and check the bubble pack prescription cards, while 23.3% of them had no change in self-efficacy. Approximately 67% of the students were more confident in their communication skills with older adults, while 26.6% were not more confident.

DISCUSSION

The implementation of a required geriatrics-focused APPE significantly improved students' knowledge, skills, and self-efficacy in providing care to older adults. Pharmacy students at VCU are exposed to a mandatory special populations course in their PharmD curriculum, which potentially contributed to the students earning a mean pre-assessment score of 53%. However, mean post-assessment scores increased to 88%, indicating that pharmacy students benefited from further geriatrics education and training during their fourth year. The time it took students to fill a prescription decreased after completing the APPE from an average of 4.0 minutes to 2.5 minutes, while maintaining a low error rate. Clearly, this required APPE not only increased students' geriatrics knowledge, but also decreased the average time required to fill a prescription, with no increase in errors. In addition to knowledge, self-efficacy is a required component to improve the care of older adults.

The majority of students (66.6-96.6%) reported an increase in self-efficacy in each category and few students reported no change in their level of self-efficacy after the APPE. There were a small number of students (6.6%) who reported decreases in self-efficacy after the APPE in their ability to communicate (ie, interview, interact, counsel) with older adults. We hypothesize that this was due to students' overconfidence in their communication abilities at baseline. The CAPE outcomes outline self-awareness as an important domain of personal and professional

Table 3. Number of Pharmacy Students per Rotation Block Completing an Advanced Pharmacy Practice Experience in Geriatrics (N = 30)

Rotation Block	Students, No. (%)
1	2 (7)
2	6 (20)
3	7 (23)
4	3 (10)
5	3 (10)
7	3 (10)
8	3 (10)
9	3 (10)

Table 4. Fourth-Year Pharmacy Students' Changes in Self-efficacy Rating Before and After Completing an Advanced Pharmacy Practice Experience in Geriatrics (N=30)

Question	Increase %	Decrease %	Same %
1. I am confident in my ability to communicate (ie, interview, interact, counsel) with older adults.	66.6	6.6	26.6
2. I am confident in my ability to appropriately screen, determine eligibility, and administer immunizations to older adults	86.6	0	13.3
3. I am confident in my geriatrics pharmacotherapy knowledge and ability to appropriately complete geriatrics medication reviews and make recommendations to providers.	96.6	0	3.3
4. I am confident in my ability to appropriately fill and check bubble pack prescription cards.	76.6	0	23.3

development, and APPEs are opportunities for students to reflect on personal knowledge, skills, and abilities that affect their growth.⁶ While students may begin an APPE with low knowledge and high confidence, there is potential for students to become more self-aware, and potentially less confident, during an APPE. However, for the majority of students, the completion of a geriatrics-focused APPE significantly increased their self-efficacy in their ability to care for older adults.

The VCU School of Pharmacy requires fourth-year students to complete 8 5-week APPEs. The geriatrics APPE was conducted in each rotation block throughout the academic year (Table 3). Regardless of when students completed the APPE, they scored higher on the post-APPE knowledge assessment than on the pre-assessment, and most students reported an increase in self-efficacy. These findings suggest that students may not be developing sufficient knowledge, skills, and self-efficacy in geriatric patient care on other APPEs, suggesting that completion of a required geriatrics APPE is essential. Our study results suggest that pharmacy students do not receive this knowledge and experience from completing APPEs in acute care, ambulatory care, and community practice alone, or even geriatrics coursework in the classroom. Including a required geriatrics APPE for fourth-year pharmacy students as a capstone experience to completing the integrated geriatrics content in the first through third years provides an important opportunity for students to improve their knowledge, skills, and self-efficacy in providing care to older adults.

CONCLUSION

Acquiring geriatrics-specific knowledge, skills, and self-efficacy is essential for pharmacy students so they will be able to effectively care for older adults once they enter practice. Our study results suggest that pharmacy students do not receive this knowledge and experience from completing APPEs in acute care, ambulatory care,

and community practice alone, or even geriatrics coursework in the classroom. Including a required geriatrics APPE for fourth-year pharmacy students as a capstone experience to completing the integrated geriatrics content in the first through third years provides an important opportunity for students to improve their knowledge, skills, and self-efficacy in providing care to older adults.

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Appendix 1. Sample Weekly Activities on Geriatrics APPE

	Monday	Tuesday	Wednesday	Thursday	Friday
Week One	Orientation. Review expectations. Tour & meet staff. Pre-assessment	10am-11am: Injection Clinic Assisted Living Rounds with Nurse Practitioner	Assisted Living Rounds with Physician 2:00pm: Discuss projects with faculty member – Bulletin Board/Newsletter	8:30am-11am: Blood Pressure Clinic 12 pm: Medication Reviews/MTM patients 1 pm: Geriatrics topic discussion with faculty member	10:30am-1pm: Cart Inspection/ Medication Administration Record Audit/ Med Pass

Non-scheduled time may be spent working on medication reviews, helping bubble pack and check prescriptions in the pharmacy, providing health screenings for residents, and more