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Research Note

Implementation of general medicine topics for acute care inpatient advanced pharmacy practice experiences

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ABSTRACT

Introduction: The purpose of this study was to describe the development of a general medicine student workbook to standardize acute care inpatient fourth-year pharmacy rotations among faculty with varied pharmacy practice sites.

Methods: Four faculty designed an advanced pharmacy practice experience (APPE) student workbook on general medicine topics consisting of short answer and multiple-choice questions to ensure standardization by exposing all students to the same topics. A pre- and posttest was administered on the first and last day of the five-week rotation block to evaluate the effects of the APPE workbook on student understanding of general medicine topics. A paired t-test was used to evaluate the significance of the difference in test scores.

Results: The average of the posttest exam was found to be significantly higher after the completion of the student workbook. The average grade on the pre-rotation 30-item exam was 22.8 (76.73%) and the post-rotation 30-item exam was 25.7 (86.26%), with a difference of 9.53% (P < .001, 95% CI = 7.11 to 11.96).

Conclusions: Creating a standardized student workbook for an inpatient acute care rotation was a valuable addition. All students assigned to the faculty involved were exposed to the same topics despite variability in preceptors and practice sites. Overall the verbal feedback from the students was positive about the student workbook and discussions, especially since the information was applicable to their patients on rotation. Faculty will continue to use this workbook as a tool to teach various inpatient general medicine topics during the acute care APPE.

Introduction

The Accreditation Council for Pharmacy Education (ACPE) Standard 13.6 requires four standard mandatory advanced pharmacy practice experiences (APPEs), including community pharmacy, ambulatory patient care, hospital/health system pharmacy, and inpatient general medicine patient care. The doctor of pharmacy (PharmD) program at Philadelphia College of Osteopathic Medicine School of Pharmacy Georgia (PCOM-SOP GA) in Suwanee, Georgia is a four-year program designed to develop a generalist pharmacist who is able to practice in different healthcare settings. Students split their time between didactic and introductory experiential learning during the first three years while the fourth year consists of eight, five-week, mandatory clinical rotations. At PCOM-SOP GA, pharmacy practice faculty are required to take APPE students on rotation throughout the year. Students choose eight of the nine available five-week rotation blocks for their mandatory experiences. Faculty members are classified as either inpatient acute care or...
ambulatory care, depending on if the practice site is an acute care facility or an outpatient clinic, respectively. Not all faculty designated as an acute care inpatient preceptor have the same specialty or practice in a similar setting at an inpatient facility. Specifically, we have four inpatient acute care faculty preceptors who have a specialty practice area in addition to general medicine. Two specialize in infectious diseases, one specializes in pediatrics, and one in oncology. These four faculty members wanted to help standardize their rotations so students not completely exposed to all general medicine topics at their respective sites could still gain understanding and have a chance to practice patient cases on uncovered topics.

There is limited data or assistance on preceptor development regarding standardization of APPEs. Most preceptor development programs primarily focus on training preceptors in pharmaceutical care and the provision of patient care. In addition to such training, some colleges of pharmacy provide additional training for community pharmacists in precepting and evaluating pharmacy students using college-designed assessment tools. There needs to be more training and resources available to standardize rotations, especially for virtual rotations during pandemic times such as the current coronavirus disease 2019.5

In general, all rotations vary and not all students are able to have the same experience depending on the site and preceptor for any rotation. To account for variations, our experiential education department has implemented a preceptor manual including development sessions, an extensive evaluation form for becoming a preceptor, and a standardized rubric. Additionally, to assist in standardization, the four above mentioned faculty members designed a student workbook with worksheets consisting short answer and multiple-choice questions (MCQs) for students to complete throughout their rotation on some of the most common general medicine topics. The purpose of this study was to discuss how the student workbook was developed and its effect on student outcomes as determined by pre- and posttest scores.

Methods

The four faculty who work in specialized practice areas wanted to find a standardized format to deliver general medicine topics to students. Using objectives from the APPE inpatient acute care syllabus at PCOM-SOP GA and ACPE standards, a student workbook was developed. Each worksheet included in this workbook was based on some of the most common general medicine topics and disease states seen on rotations. Worksheets comprised of patient cases and short answer or MCQs to simulate cases students may see during an acute care inpatient rotation. Fig. 1 outlines the content of the workbook. Topics were evenly divided among faculty members and they developed two worksheets for each of their assigned topics with approximately 10 short answers and/or MCQs per topic (see Fig. 2 for a sample worksheet on “Clostridium difficile infection” and MCQs). The worksheets were compiled to make two large workbooks (versions A and B) for students to complete during the five-week block. A pre- and posttest was developed to assess retention of the material and evaluate the effectiveness of the workbook. The questions on the pre- and posttests were reflective of the topics covered in the APPE workbook and consisted of the same 30 questions. Faculty decided to cap the number of questions at 30 to minimize the length of the test. Language and delivery of questions were reviewed and edited based on the feedback provided by other faculty members and pharmacy residents. Students were given the pre and post multiple-choice tests at their sites on their first and last day of the five-week rotation and had 45 min to take the exam. After completing the pretest on the first day of the rotation, students were given the student workbook to work on individually during the five-week block. Preceptors discussed each worksheet with the students throughout the rotation and prior to the posttest. Data were collected on the pre- and posttest grades throughout the academic year from May 2018 to November 2019. This study was reviewed and approved by the PCOM-SOP GA institutional review board. Paired t-tests were performed to evaluate statistically significant changes between pre- and post-rotation test scores. All statistical analyses were conducted using SPSS, version 23.018 (IBM, Corp.).

Results

Fifty students participated in completing the student workbook over the study period. Students were required to complete a 30-item test before and after the rotation. For all 50 students, the pre-rotation test mean score was 22.76 (76.73%; SD = 8.79%) while the mean score for all students on the post-rotation test was 25.65 (86.26%; SD = 8.37%). A paired t-test found that the score on the post-rotation test increased significantly (difference = 9.53%, 95% CI: 7.11% to 11.96%, \( P < .001 \)) compared to the pre-rotation test.

The scores on the tests varied based on the rotation block the students were completing (Fig. 3). No students were on an acute care inpatient rotation with the faculty preceptors during block eight, therefore no data was collected for this block. The study could not find any significant difference in mean post-rotation test score (difference = 2.34%, 95% CI: −2.53% to 7.4%, \( P = .34 \)) between students who completed the rotation during blocks five through nine (mean score = 87.67%, SD = 9.29%) compared to those who completed the rotation during block one through four (mean score = 85.33% SD = 7.73%).

Discussion

Fourth-year APPEs reinforce the knowledge acquired during the previous three years at a PharmD program. Students are provided an opportunity to apply what they have learned from their curriculum to real patient cases during this time as well. At PCOM-SOP GA, students on their acute care inpatient APPEs with preceptors practicing in a specialty area such as oncology, infectious diseases, and pediatrics, were not exposed to all general medicine disease states due to the limited population at these sites. The utilization of the student workbook during APPEs showed improved knowledge and retention of these topics based on pre- and post-rotation test scores. It provided a structured approach to complement learning of general medicine topics that was already happening at the APPE
Fig. 1. Topics in student workbook.

1. Stress ulcer prophylaxis
2. Conversion of oral to intravenous dosage forms
3. Renal dose adjustments for medications
4. Febrile neutropenia
5. Total parenteral nutrition
6. Acetaminophen overdose
7. Dyslipidemia
8. Hypertension
9. Multidrug resistant organisms
10. Antibiogram interpretation
11. Pharmacokinetics
12. Anticoagulants
13. Pneumonia
14. Clostridium difficile infection
15. Urinary tract infections
16. Diabetic foot infections
17. Skin and soft tissue infections
18. Diabetic ketoacidosis
19. Asthma
20. Chronic obstructive pulmonary disease (COPD)
21. Complications of liver and kidney diseases
sites with oncology, infectious diseases, and/or pediatric patient cases and interactions. Verbal feedback from students and post-rotation evaluations also showed anecdotal positive impressions of the APPE workbook. Questions included in each worksheet led to an in-depth discussion with preceptors and therefore a better understanding of the topic. Students were especially thankful when they could apply what they learned from their worksheets to their patients on rotation. Several students also stated that they would utilize the APPE workbook as a tool to study for their board exams. Anecdotal data from preceptors suggest that the students who complete the worksheets may be more prepared and confident in dealing with general medicine patient cases and topic discussions compared to students on rotation prior to the implementation of the workbook.

Other studies have evaluated the impact of various interventions on APPEs. A study by Hardy and Marshall evaluated the impact of a course created to give students the opportunity to learn in a fictitious health system that closely mimicked APPEs. The authors of this study found that this course enabled students to experience an APPE environment where they could integrate knowledge learned

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**Workbook Worksheet**

- What is *Clostridium difficile* and how does infection spread?
- What are some complications of CDI?
- What are some risk factors of CDI?
- When would CDI testing be necessary?
- How is CDI diagnosed?
- What is the first step in managing CDI?
- What are the types of infection prevention parameters for CDI?
- What is the recommended treatment for an initial non-severe episode of CDI?
- What is the recommended treatment for an initial severe episode of CDI?
- What is the recommended treatment for an initial fulminating episode?
- What is the recommended treatment for a second or recurrent CDI?
- Explain the use, MOA, and dose of Zinplava (bezlotoxumab).

**Exam Questions:**

1. The risk for *Clostridium difficile* is increased in patients with:
   - a. Antibiotic exposure
   - b. Proton pump inhibitors
   - c. Gastrointestinal surgery/manipulation
   - d. A and C
   - e. A, B, and C

2. Which agent would be most appropriate to initiate in a patient who presents with watery diarrhea, fever, and had a stool sample test positive for *C. difficile*?
   - a. Metronidazole IV
   - b. Clindamycin IV
   - c. Cephalexin PO
   - d. Vancomycin PO

CDI = *Clostridium difficile* infection; IV = intravenous; MOA = mechanism of action; PO = by mouth.

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**Fig. 2.** *Clostridium difficile* infection worksheet and exam questions.

**Fig. 3.** Pre- and posttest results by raw score (max 30).
in previous courses and apply it.3 Students who participated in this course reported a higher level of confidence in performing activities required in clinical practice.3 Additionally, Medina et al.4 evaluated the impact of a pre-rotation workshop on pharmacy students‘ skills and preparation for APPEs. The authors found that the workshop had a positive impact on students and was successful at advancing their clinical skills and preparation for rotations.5 Similar to these studies, non-traditional methods of teaching such as the APPE workbook described in this study, improved student learning outcomes.

Although faculty members involved in this study had observed positive impact on the performance and confidence of our students, our experience does have limitations. Due to the limited number of students during the study period, our sample size was small, and therefore the true impact of the intervention cannot be appreciated at this time. Additionally, we were not able to remove confounders of the study sample as some students may have been more academically advanced than others. Preceptors have also observed that APPE students in the first half (blocks one through four) typically do not perform as well as the students in the second half of the academic year (blocks five through nine) due to lack of experience. Lastly, the variability in practice settings among faculty may contribute to variability in study results as well, as some faculty may have had more diverse patient population than others.

Conclusions

Experiential education is a key component of the PharmD curriculum and it allows students to experience integrated training of what was learned in the classroom applied to the practice of pharmacy. Pharmacy programs are tasked with training students on their experiential rotations to become entry-level practitioners upon graduation. Programs often rely on the expertise of practicing pharmacists to serve as preceptors and provide students opportunities to develop and demonstrate the skills needed for practice. As the practice of pharmacy expands to include various practice settings and more complex direct patient care, the training required must also advance to prepare students for such practice. As such, students on experiential rotations with specialized faculty or pharmacy preceptors in a unique area of practice gain important knowledge of that patient population. However, it is crucial to ensure that students remain well rounded and continually build upon the knowledge of the most common disease states. The integration of a “student workbook” learning module within an APPE is a relatively simple practice with significant outcomes that also assists in standardizing a method to help students prepare for the North American Pharmacist Licensure Examination. As demonstrated in our experience, utilization of the APPE workbook improved post-rotation test scores in our students. Verbal feedback from students also indicated that such addition was beneficial to their learning. Pharmacy preceptors, especially faculty preceptors at schools of pharmacy, may benefit from such standardized learning modules which can be utilized in a variety of settings, including but not limited to general medicine. These learning modules can assist to ensure that all students maintain the basic knowledge of most common clinical pharmacy topics. The student workbooks at other institutions can be developed based on the identified gaps in the curriculum, specific to the institution, or even tailored specifically to individual students who demonstrate gaps in knowledge. In concordance with similar studies, such as those performed by Bailey et al.,3 and Wilson et al.,6 additional educational experiences delivered in non-traditional settings to APPE students have a positive impact on their knowledge and confidence in practice. Developing a workbook can assist in times of having to do educational learning sessions virtually as well, such as during the pandemic in 2020.

Declaration of Competing Interest

None

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