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Research

# Assessment of core knowledge during ambulatory care advanced pharmacy practice experiences using online modules and pre- and post-testing

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## Abstract

**Objectives:** To evaluate whether knowledge on core ambulatory care topics, as measured by pre- and post-testing, improved during ambulatory care advanced pharmacy practice experiences (APPEs) after completing online modules and topic discussions individualized to specific student needs.

**Methods:** Preceptors for eight ambulatory care APPE sites developed a 54 question pre-post-test and online modules for 10 knowledge areas, which include guidelines, algorithms, literature, clinical pearls, special populations, lecture handouts, patient education resources, and a self-assessment quiz. Online modules and individualized learning experiences were required for content areas with a score of <60% on the pre-test.

**Results:** Overall, 70 students were evaluated. The mean overall pre- and post-test scores were 65.1% and 86.3%, respectively [mean change 21.2% ( $p < 0.0001$ )], and improvement in each content area was significant.

**Conclusion:** The use of individualized online modules and topic discussions based on pre-test scores significantly improved student knowledge in core ambulatory care content areas during APPEs.

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**Keywords:** Ambulatory care; Advanced pharmacy practice experience (APPE); Pre- and post-testing; Individualized learning

## Introduction

Clinical knowledge is the foundation for safe and effective pharmacy practice. The latest Standards and

Guidelines for the Professional Program in Pharmacy set forth by the Accreditation Council for Pharmacy Education (ACPE) require that Advanced Pharmacy Practice Experiences (APPEs) integrate, apply, reinforce, and advance knowledge, skills, attitudes, and values.<sup>1</sup> Accreditation Standards also require that all pharmacy practice experiences have general objectives and learning modules and that student performance and attainment of desired outcomes should be assessed and documented.<sup>1</sup> A white paper on Quality Experiential Education from the American College

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of Clinical Pharmacy (ACCP) states: “Students should be specifically assessed on knowledge. Core knowledge competencies and related assessment measures should be included for each experience rather than just providing an overall subjective assessment of quality of knowledge base. The mastery of this knowledge can be assessed through written and verbal examinations.”<sup>2</sup> A related ACCP position statement on Experiential Education states: “Knowledge assessments should be objective and based on student performance in predefined content areas for each experience” and “Assessments should be standardized to ensure that all students who are completing a specific experience are assessed in the same fashion, regardless of experiential site.”<sup>3</sup> Outcome 1.1.4 in the 2013 educational outcomes from the Center for the Advancement of Pharmacy Education (CAPE) states that students should “apply knowledge from foundational sciences to solve therapeutic problems and advance patient-centered care.”<sup>4</sup> During APPEs, students apply knowledge acquired during the didactic portion of pharmacy education to provide patient-centered care.

Pre- and post-testing is a way of assessing knowledge, identifying deficiencies, and ensuring that assessments are uniform, objective, and standardized. Once individual student weaknesses have been identified from pre-test scores, learning experiences can be personalized. The use of pre- and post-testing during ambulatory care APPEs has been discussed in the literature. Burkiewicz et al.<sup>5</sup> utilized pre- and post-testing with multiple-choice questions covering content in three of seven core therapeutic areas selected by the preceptor. The core areas were anticoagulation, atrial fibrillation, asthma, diabetes, hyperlipidemia, hypertension, and smoking cessation. There was significant improvement from pre- to post-test scores in the overall, diabetes, dyslipidemia, and anticoagulation scores. The authors suggested that “future studies may wish to formally document how pre-test scores were used in tailoring rotation activities.”<sup>5</sup> Masters et al.<sup>6</sup> conducted a similar study assessing pre- and post-test scores during ambulatory care rotations across multiple sites. Identical pre- and post-tests were comprised of short-answer questions in four core areas (hypertension, diabetes, hyperlipidemia, and anticoagulation). Although there was no formal method to address individual student deficiencies, “disease-state discussions” occurred during the rotation on these four core areas. There was significant improvement from pre- to post-test scores in the overall score as well as in each core area.

Pre- and post-testing in other APPE pharmacy settings, including inpatient, focused diabetes care, and coronary heart disease risk assessment, has all shown significant improvement in scores.<sup>7–9</sup> Similar findings utilizing online curricula have been reported in medicine and dentistry.<sup>10,11</sup> However, most of these studies did not implement focused interventions based on identified areas of weakness following the pre-test. Instead, they only evaluated the effectiveness of the specific rotation, curriculum, or knowledge area(s).

At the University of Minnesota College of Pharmacy, students are required to complete a five-week APPE in an ambulatory care setting. Students may also choose to complete additional elective ambulatory care APPEs. Elective ambulatory care APPEs typically focus on specific disease-state management and do not involve as much direct patient care and comprehensive medication management as the required ambulatory care APPEs. Although students could potentially complete four elective ambulatory care APPEs, most students do not complete elective ambulatory care APPEs at all. While learning objectives for ambulatory care APPEs may be consistent across sites, assessment methods generally rely on the preceptor’s subjective evaluation of student knowledge and performance. Core knowledge areas are often not specified, and preceptors do not employ a standard approach to identify and address deficiencies in a student’s knowledge base. Furthermore, core knowledge is not objectively assessed at the end of the APPE to ensure competence. A well-designed APPE should include an objective knowledge assessment of core knowledge competencies, student-specific learning goals and activities, and an objective assessment at the conclusion of the APPE.<sup>2</sup> Learning activities would ideally focus on core ambulatory knowledge areas and would challenge the student.

Standardizing teaching and assessment approaches in experiential education are complicated by geography and the heterogeneity among multiple sites and preceptors. In order to fulfill the recommendations set forth by ACPE, CAPE, and ACCP for an integrated outcomes-based curriculum, clinical faculty from the University of Minnesota College of Pharmacy sought to define core knowledge areas for ambulatory care APPEs, find more effective and efficient mechanisms for sites to deliver standard content, and provide objective assessments of student knowledge in the core areas.

The primary outcome of this study was to determine if student pharmacist’s clinical knowledge on core ambulatory care topics, as measured by pre- and post-testing, improved from baseline to completion of a five-week ambulatory care APPE after engaging in direct patient care and individualized learning activities. Secondary outcomes were to compare pre- and post-test performance in individual core knowledge areas and to explore what factors impacted pre- and post-test performance. Factors that were assessed include prior ambulatory care APPEs, prior ambulatory care work experience, prior didactic patient care electives, didactic grade point average (GPA), and timing of APPE (early-blocks 1–3; mid-blocks 4–6; and late-blocks 7–9).

This study adds to the current body of evidence supporting pre- and post-testing as a means to tailor APPE activities to student deficiencies identified by a pre-test. Resolution of these deficiencies is then measured by performance on a post-test. Although pre- and post-testing has been described in the literature, its role

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