Objective Structured Clinical Examinations as an Assessment Tool in Pharmacy Curricula

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ABSTRACT. The pharmacy education literature reveals that the clinical performance of students is less than that expected by faculty. Because assessment methods can substantially influence education, poor performance may be improved with more innovative methods of clinical assessment, such as those that involve the use of standardized patients. This manuscript describes the development, coordination, and assessment of the objective structured clinical examinations (OSCEs) administered over three semesters to the same class of students at the University of North Carolina at Chapel Hill. Results of this project indicate that despite the substantial financial expenditures associated with administering OSCEs, both students and faculty find these exams a valuable learning experience.

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BACKGROUND

The use of standardized patients (SPs) in medical education is becoming an important means of assessing clinical competence when interacting with patients and health care providers. By definition, the SP is a person, whether an actor or an actual patient, who is trained to present an illness in a consistent and standardized way (1). The SP has been taught to present a problem so accurately that a skilled clinician cannot detect the simulation easily (2). Because the presentation varies minimally from student to student, direct comparisons of performance can be made. In this way, SPs can be used for evaluating knowledge and clinical skills that cannot be validly assessed through written examinations (3). Further, this assessment method allows direct and reliable assessment of clinical performance on a large scale (1).

The use of SPs in medical education can be traced back to 1963, when neurologist and medical educator Howard S. Barrows used a simulated patient to evaluate third-year neurology clerks at the University of Southern California. In the mid-1970s, Paula Stillman at the University of Arizona used patient instructors to teach medical students how to perform complete and accurate physical exams. Later she began to use patient instructors who displayed the appropriate physical findings for this purpose. The movement has grown substantially over the years. A 1993 survey revealed that 80% of responding medical schools were using standardized patients for teaching and assessment (4).

When SPs are used to assess clinical skills, most medical schools use the objective structured clinical examination (OSCE) approach (1). The OSCE is designed to test specific skills and generally involves progressing through several skill stations. A student might be asked to take a blood pressure on a patient at Station 1, elicit a substance abuse history from a patient at Station 2, and start an intravenous medication on a model arm at Station 3. The time spent at any one station during an OSCE is short, usually four to ten minutes. Faculty can evaluate the student's performance; however, the SPs can be trained to do this as well (4).

The use of OSCEs in medicine has become a standard for evaluating the clinical performance of medical students and residents. In 1993, the Medical Council of Canada became the first organization to implement

a national standardized patient-based performance assessment as a requirement of the licensing exam. In the United States, this was authorized by the Educational Council for Foreign Medical Graduates in 1993 and the National Board of Medical Examiners in 1995 (4). The OSCE has been studied extensively as an assessment method in undergraduate and postgraduate medical training, and the validity and the reliability of OSCEs have been successfully demonstrated (5). Ferrell published a primer that includes the common terminology and concepts associated with using standardized patients in clinical performance assessment (6).

In the last decade, pharmacy educators have recognized the value of SPs and OSCEs in student assessment and have begun experimenting with this approach (7,8). In pharmacy education, however, the SP can be expanded to depict a standardized participant because he or she can play the role not only of a patient, but also of a physician, nurse, or other health care provider with whom the pharmacist might interact. Monaghan maintains that the use of standardized patient evaluators is critical to ensuring that students can independently accomplish clinical problem solving in pharmacy (9).

One pharmacy-specific program similar to the OSCE is the pharmaceutical care encounters program (PCEP) that measures pharmacy student performance in the areas of knowledge, problem-solving skills, and communication skills. In addition, it helps to identify student and clerkship site deficiencies (9). A pilot PCEP measuring student performance on an adult medicine experiential clerkship has been described in the literature (10). More recently, OSCEs have been incorporated into intensive continuing education certificate programs and continuing competency examinations. Such programs serve as a mechanism for pharmacists to upgrade their clinical skills to remain viable health care providers (8,11,12).

PURPOSE

The purpose of this project was to introduce and evaluate an innovative approach to test administration in the professional program at the University of North Carolina School of Pharmacy. At the time this project was begun, our curriculum included five semesters of pharmaceutical care laboratory (PCL) courses.

The PCL sequence provides students with early introduction and ongoing opportunities to practice and refine a variety of skills and abilities

needed to provide effective patient care. PCL courses emphasize process, rather than content, and are designed to help each student:

- Apply and integrate content from courses in the core professional curriculum into a functional knowledge and skill base
- Practice and refine intellectual, interpersonal, and technical skills related to professional practice
- Develop skills and strategies to facilitate lifelong learning and career development
- Reflect upon personal and professional attitudes and values
- Develop responsible personal habits and professional behaviors.

Each PCL course meets 5 to 8 hours per week, with students divided into groups of no more than 12 and facilitated by a teaching assistant (i.e., a senior student, graduate student, or pharmacy resident). Various instructional methods are used throughout the series, both to enhance interest and to ensure adequate practice to master important concepts and skills.

The five PCL courses were designed to build upon one another and end with both written examinations and clinical skills assessments using faculty, staff, and teaching assistants as both patients and evaluators. In the past, these end-of-semester skills assessments were guided by a philosophy of remediation, and students repeated the skills until all were accomplished successfully. Challenges inherent to that system included standardization of performance, dependability of faculty and staff volunteers, validation of the results, and correlation with overall course performance.

In an effort to improve upon this system, faculty selected the graduating class of 2001 at the University of North Carolina at Chapel Hill to participate in a pharmacy OSCE program concomitant with their pharmaceutical care laboratory classes. The students participated in traditional skills assessments during their first professional year of the curriculum. Following this, the students participated in end-of-semester OSCE assessments during fall of their second professional year, spring of their second professional year, and fall of their third professional year. During each semester, they were provided with information regarding exam process and structure, specifics about the weight of the exam in determining their final course grade, and tips about effective test-taking skills. In addition, the students were given a list of approximately 25 potential skills to be assessed with the caveat that the exams would be cumulative over the 3 semesters.

METHODS

Exam Preparation

The associate dean for professional education, director of curricular affairs, director of the pharmaceutical care laboratory program, course coordinators, course instructors, and an educational consultant met to review the pertinent research literature and to determine a template for the exam. In further meetings, they appraised course content to determine which and how many skills would be tested during each exam.

Across the published studies, reliability analyses indicated consistently that the major source of measurement error for OSCEs was variation in examinee performance from station to station, implying that tests must include large numbers of stations to obtain a stable, reproducible assessment of examinee skills (13). Limitations of space and funding, however, as well as cost-minimizing strategies published by Poenaru, led to the development of an exam in which five stations would include SPs as trained evaluators (14). In the third offering of the examination, the results of the standardized patient-based performance assessment were combined with non-patient-based assessments to provide more information about student achievement.

The skills chosen for each exam were representative of the techniques taught in concurrent or prior lab courses and were related to disease states and professional issues being taught in concurrent or prior courses throughout the curriculum. The skills selected are listed by semester in Tables 1-3.

Developing the Scenarios

A scenario was developed for each patient case giving a brief medical history for each patient, the reason for the patient's visit to the pharmacy, and brief responses to questions the patient might be asked by the student. Using the teaching outline for each of the three courses, eight to ten items were designated as checkpoints for performance of the skill. The content and design of the assessment checklist reflected the knowledge and skills that trained standardized patients could assess. Cases were adapted from those used in previous skills examinations not using standardized patients, although patient names were changed. Historical controls were used to determine the initial timing sequence (i.e., what a student could be expected to complete during the testing period), although instruments were refined as the training progressed.

TABLE 1. Skills Evaluated in Fall 1998.*

- Counseling on oral contraceptive therapy (Ortho Novum® 1/35-28)
- Teaching blood glucose monitoring (Glucometer Elite®)
- Teaching peak flow meter technique (Tru-Zone®)
- Teaching subcutaneous injection technique
- Teaching metered dose inhaler technique (placebo inhaler)

*OSCE accounts for 10% of overall course grade

TABLE 2. Skills Evaluated in Spring 1999.**

- Teaching the use of an electronic home BP monitor (Omron®)
- Counseling on anticoagulant therapy (Coumadin®)
- Teaching metered dose inhaler with a holding chamber technique (placebo inhaler + Aerochamber®)
- Measuring pulse and blood pressure using an aneroid sphygmomanometer
- Counseling on medications for attention deficit hyperactivity disorder (Ritalin®)

**OSCE accounts for 20% of overall course grade

TABLE 3. Skills Evaluated in Fall 1999.***

- Counseling on selection and use of OTC iron supplements for a patient currently using tetracycline for acne
- Teaching appropriate insulin mixing technique
- Counseling on Ortho Novum® 1/35-28/drug interaction with antibiotic
- Instruction on using an ambulatory infusion pump (elastomeric reservoir type) for antibiotic delivery
- Counseling on erythromycin/recognition of drug interaction with cisapride

***OSCE accounts for 20% of overall course grade

For the initial examination (December 1998), each checklist included eight to ten items to be scored as either completed correctly or not completed correctly. Changes were made based on the comments of standardized patients and students, and for subsequent examinations (April 1999, December 1999), each checklist included eight to ten items to be scored as either completed correctly, attempted but did not complete

correctly, or did not attempt. The OSCE administered as part of the third-year course work included a two-part rating system: the first, for technical skills and the second, for patient interaction skills. Once cases and checklists were finalized for the first OSCE offering, they were piloted on a group of pharmacy residents. Thereafter, the previous exam offering served as the pilot. Examples of a patient scenario and an assessment checklist are shown in Tables 4 and 5, respectively.

Selecting and Training the Standardized Patients

Once the case scenarios were complete, SPs were recruited and trained based on the physical needs of the case (e.g., a female patient of childbearing age for an oral contraceptive counseling case). Recruitment was accomplished by posting advertisements in local newspapers as well as using a database of previous patients from the medical school program. Wages of $10/hour were advertised, and SPs were paid for time spent in training for and performing the examinations.

A total of 20 SPs were hired to participate in each exam. Each case was assigned to four patients. The educational consultant learned the

TABLE 4. Sample Patient Scenario.

PREGNANCY TEST SCENARIO

Patient identifies herself as Jill Bennett a 30yo female who has a question for the pharmacist. Jill Bennett displays an e.p.t.® pregnancy test and asks the pharmacist the following questions:

"Is this test any good? I'm a few days late this month (3 if asked further) and I want to know if I am pregnant. I've been off the pill (Ortho-Novum 1/35-28 if asked further) for 6 months and I just feel like I might be pregnant this time. My husband has been on a business trip and I would love to surprise him with the news tonight!"

Jill Bennett then says, "I see you have these e.p.t.® tests for sale . . . can you show me EXACTLY how to do it? I am so nervous, I am scared I will forget if you don't go through it with me."

NOTE: THERE SHOULD BE A CARD TAPED TO THE TABLE WITH INSTRUCTIONS TO USE THE OPEN KIT FOR DEMONSTRATION. BETWEEN EACH STUDENT THE SP SHOULD RETURN ALL INSTRUMENTS TO PACKAGING.

Supplies needed:

☐ 2 e.p.t.® tests

TABLE 5. Sample Assessment Checklist.

PREGNANCY TEST ASSESSMENT

1. Pharmacist introduces self and identifies self as pharmacist.

Pharmacist educates patient by performing the following demonstration:

2. Removes the e.p.t.® stick test from foil packet, removes the purple cap to expose absorbent tip.
3. Holds the test stick by its thumb grip. Points the absorbent tip downward. Describes placing the absorbent tip in urine flow for 5 seconds.
4. Demonstrates placing the test stick on a flat surface with the windows facing up for at least 3 minutes but no more than 20 minutes. Can cover absorbent tip with cap during this process. Describes a light pink color moving across the windows.
5. Describes a positive result: two distinct parallel lines, one in each window. (Lines can be different shades of pink.)
6. Describes a negative test: one line in the square window and no line in the round window.
7. Describes an invalid test: no line appears in the square window.
8. Asks patient to repeat steps and assesses understanding.
9. Closes the interaction with contact information in the case of additional patient questions.

practice skills during the same laboratory sessions as the students. The consultant then served as the trainer for the SPs, with the course coordinator serving as a secondary check. The SPs were trained in their groups of four, then divided into two buddy groups having an A and a B in each group. This pairing served to decrease SP fatigue by providing adequate rest during the sessions. The assignment of SPs to their first specific time slots was made in a random fashion. When the test was performed, SPs participated in the order depicted in Table 6.

Administering the Exams

Each semester, the exam was administered over four days, lasting three hours each day. The 114 students were divided into 12 groups of approximately 10 students each. This was consistent with their previously assigned small groups for the lab courses. There was no attempt to match specific students with specific SPs, as there was no prior relationship between these groups.

TABLE 6. Order of Standardized Patients.

	Hour 1	Hour 2	Hour 3
Day 1	A	B	A
Day 2	B	A	B
Day 3	A	B	A
Day 4	B	A	B

Each exam consisted of five cases, and each case was allotted ten minutes (six minutes for the student to perform the skill, two minutes for the SP to score the student and give feedback, and two minutes to move to the next station). Each group of 10 students completed the exam in 50 minutes, with 10 minutes set aside for SP breaks and preparation for the next student group to begin.

A standardized audiotape announced the times and dictated the movement of the students through the exam. Teaching assistants served as marshals and timekeepers to assist if equipment failed and to ensure the correct movement of students from one station to the next.

Figure 1 depicts the layout of the two adjacent areas used to administer the exam. In each case, one student/SP pair was located in each of the five case rooms, with marshals and timekeepers located in the common areas.

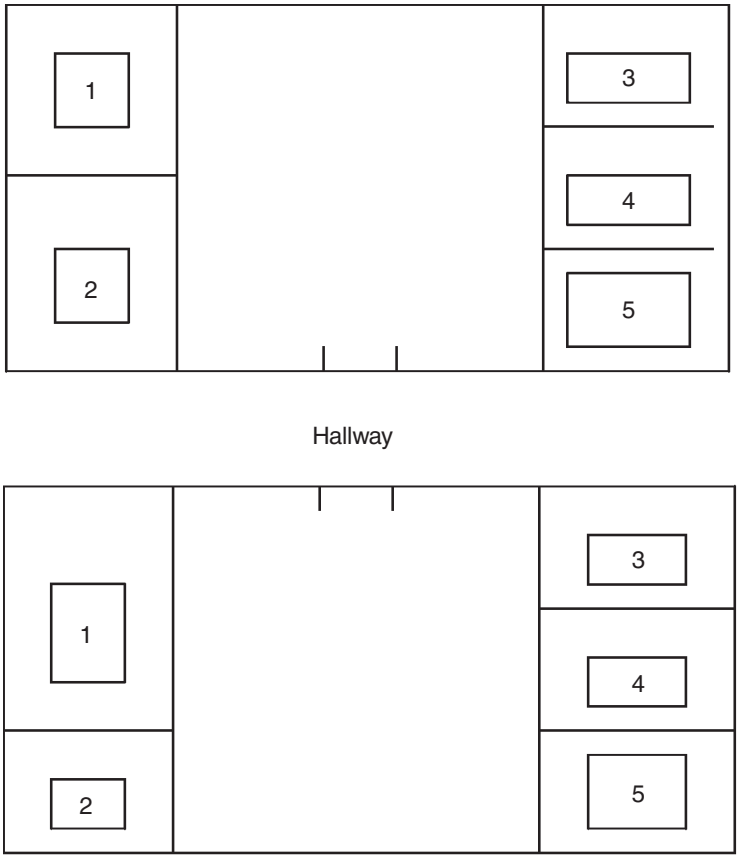
For scoring purposes, each student was given a sheet of bar code stickers. As the student completed each station, she or he gave a bar code sticker to the SP. The SP affixed both the student bar code and an individual SP bar code to a case-specific Scantron® score sheet. At the conclusion of each exam day, student score sheets were collected from the SPs, scanned into a data set, and verified.

RESULTS

Examination

The exam results were compiled and reported as percentage correct, mean for group, and standard deviation. The maximum score for each skill was 100 points. After analyzing the results by student group and by SP, no systematic problems with scoring were found. Tables 7, 8, and 9 describe the mean score for each examination. Because prior skill as-

FIGURE 1. Exam Layout.



sessments were repeated until each student performed all skills correctly, there was no baseline assessment to which scores could be compared. In addition, although the third exam offering (December 1999) included some non-SP-based assessment, for comparability only the SP results are reported.

To evaluate inter-rater reliability, during the first exam session (December 1998), an independent evaluator scored six scenarios selected at random. In these cases, there was agreement between the primary evaluator (the standardized patient) and the secondary evaluator (the course coordinator) in 98% of the categories.

TABLE 7. Scores for Fall 1998.

Skill	**Mean score (± SD)**
Counseling on Ortho Novum® 1/35-28	89.03 (8.9)
Teaching blood glucose monitoring	89.85 (0.95)
Teaching peak flow meter technique	90.05 (0.75)
Teaching subcutaneous injection technique	89.38 (0.75)
Teaching metered dose inhaler technique	89.38 (0.48)

TABLE 8. Scores for Spring 1999.

Skill	**Mean score (± SD)**
Teaching the use of an electronic home BP monitor	81.13 (7.58)
Counseling on Coumadin®	88.38 (8.25)
Teaching metered dose inhaler with a holding chamber technique	87.42 (5.25)
Measuring pulse and blood pressure using an aneroid sphygmomanometer	86.29 (6.63)
Counseling on Ritalin®	89.75 (8.75)

TABLE 9. Scores for Fall 1999.

Skill	**Mean score (± SD)**
Counseling on selection and use of OTC iron supplements for a patient currently using tetracycline for acne	83.65 (12.87)
Teaching appropriate insulin mixing technique	88.73 (11.74)
Counseling on Ortho Novum® 1/35-28 + drug interaction with antibiotic	81.38 (14.27)
Instruction on using an ambulatory infusion pump (elastomeric reservoir type) for antibiotic delivery	81.01 (13.18)
Counseling on erythromycin/recognition of drug interaction with cisapride	79.67 (23.30)

Survey

At the conclusion of the exam, each student was asked to complete an exit questionnaire regarding his or her attitudes toward and experiences with the exam. Each questionnaire consisted of several statements for

which the students used a Likert scale to respond. At the time that students completed the questionnaire, they were not aware of their overall numeric grade, although they had received feedback from the SPs regarding their performance on the individual cases. The results of this survey are shown in Table 10.

DISCUSSION

The purpose of this project was to incorporate assessment simulating genuine patient interaction into the pharmaceutical care laboratory curriculum in the School of Pharmacy at the University of North Carolina at Chapel Hill; this goal was achieved successfully. In general, students appeared to learn from the process and to appreciate the opportunity to work with standardized patients previously unknown to them. Although using SPs minimized systematic bias, there were (infrequent) complaints by the students that they had performed the skill correctly, but the SP had not given them the appropriate credit. Often, this confusion involved the student using terminology inappropriate for lay communi-

TABLE 10. Student Opinions of OSCE Process.

Statement	F98*	S99**	F99***
1. I feel the OSCE fairly assessed pharmacy practice skills.	4.16	3.51	3.67
2. I feel the OSCE was more relevant than previous exam experiences.	4.25	3.47	3.76
3. I feel the OSCE was less stressful than previous exam experiences.	3.21	2.96	3.54
4. I enjoyed having the opportunity to work with standardized patients.	4.56	4.15	4.14
5. The simulated patient scenarios were realistic.	4.30	3.92	3.89
6. I would like to incorporate more OSCE opportunities into the pharmacy curriculum.	4.14	3.43	3.86
7. I feel the time allotted to demonstrate the skills was . . .	1.44	1.61	1.72

*n = 107, **n = 98, ***n = 106
Scale for statements 1-6:
1= strongly disagree; 2 = disagree; 3 = not sure; 4 = agree; 5 = strongly agree
Scale for statement 7:
1 = too little 2 = just right 3 = too much

cations (e.g., counseling the patient about epistaxis instead of a nosebleed). Questions by SPs about how to evaluate behaviors not described in the checklist (e.g., a student who demonstrated the ability to mix insulin correctly but administered the wrong dose) arose and were addressed on a case-by-case basis.

Although the exit survey does not appear to support this conclusion, anxiety about the testing process appeared to decrease with each subsequent examination. In addition, there was a trickle-down effect to the junior students, who demonstrated much less anxiety when taking their first OSCE. Finally, the standardized patients, many of whom were retirees or nonpharmacy graduate students, enjoyed the experience thoroughly and were able to provide tremendous feedback about the performance of our students.

The OSCE format has proven useful to assess skills not adequately assessed via written examination, including basic interviewing, physical assessment, and counseling. However, there are some concepts, such as continuity of care, that standardized patient exams cannot measure well, regardless of format. Most importantly, Wallace remarks that OSCEs can determine whether a student is capable of carrying out a particular skill, but do not determine whether the student will use that skill with an appropriate problem (4). The investigators and educators associated with this project eagerly await feedback from our clerkship preceptors to determine if the class of 2001 performs at a higher level of patient care than classes who did not participate in OSCEs.

Although every attempt was made to use best practices for this educational project, a significant limitation is that five stations per examination is not ideal for making sound inferences based on these results.

LESSONS LEARNED

The literature supports a variety of formats for OSCEs, and it is beyond the scope of this manuscript to recommend a universal mechanism for every interested program to proceed with standardized patient examinations. From our experiences, however, we offer the following caveats:

1. Whenever possible, faculty members, including clerkship preceptors, should be incorporated into the decision about which skills are tested and how much the assessment counts toward successful completion of the course. Faculty observers will not only increase

the face validity of the examination process but also can make difficult decisions about necessary changes in curricula based on the results. The process is resource-intensive, and some faculty may not agree with the significant expenditure associated with administering OSCEs, so involving them in the planning process can be very important.

2. It is clear that despite cost and measurement challenges, OSCEs are becoming an integral part of the way medical and pharmacy students are assessed. While the authors have personal knowledge of several programs using some form of standardized patient-based assessment, published accounts of the development, use, and measurement characteristics of these examinations have been less than extensive. Individuals working on clinical performance assessment using standardized patients in pharmacy have been, with only few exceptions, working in separate vacuums. Little collaboration has occurred to date, and individual efforts have only recently been shared. This is a deficit in pharmacy education not currently seen in medical education.
3. As discussed, one of the greatest threats to the validity of inferences that can be made from the results of OSCEs is that the performance is contextual and can vary from station to station. The literature recommends that a large number of stations strengthen the ability to extrapolate the results; however, resources were not available to support this. In retrospect, the authors would consider studying the combined student scores across all assessments (in this case, 15 stations over 3 occasions) to permit this extrapolation. By the third exam offering, however, the examination process was modified to include both SP-based and non-SP-based assessment to address this concern.

CONCLUSIONS

The authors of this report encourage other faculty who are experimenting with assessment techniques using SPs to share these findings via publication and presentation at professional meetings. Further, they encourage the American Association of Colleges of Pharmacy (AACP) to collect information regarding this methodology and its applications to pharmacy education. A centralized database of validated case scenarios could be an important tool in cost minimization for schools planning to implements OSCEs.

OSCEs have become an integral part of the standard course of study at the University of North Carolina at Chapel Hill School of Pharmacy. Experience has demonstrated that OSCEs are valuable in assessing skills not adequately assessed via written examinations and that students perceive the encounters as meaningful. The OSCE process continues to undergo refinement, and further assessment of these skills during the clerkship year will help determine the overall benefit of OSCEs in preparing students for practice.

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