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INSTRUCTIONAL DESIGN AND ASSESSMENT

Physical Assessment Experience in a Problem-Based Learning Course

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Objective. To evaluate the impact of a physical-assessment learning experience implemented in the problem-based learning (PBL) format of the third year of a doctor of pharmacy (PharmD) program.
Design. Students enrolled in a PBL course completed survey instruments to measure knowledge and confidence before and after participating in the learning experience. A simulation stethoscope was used to teach students abnormal pulmonary and cardiovascular sounds in 1-hour sessions for each of 12 PBL groups.
Assessment. The 92 students enrolled in the PBL course completed pre- and post-experience survey instruments. Students' scores on knowledge questions increased significantly ($p < 0.0001$) from 40.4% ± 11.4% at baseline to 62.5% ± 13.7% and 63.1 ± 11.6%, respectively, on the 2 sets of post-experience questions. Students scored a median of 3 or 4 on a 5-point Likert scale after a learning experience on questions measuring confidence.
Conclusion. Use of a simulation stethoscope in a physical-assessment learning experience increased pharmacy students' knowledge in performing pulmonary and cardiovascular assessment techniques.
Keywords: physical assessment, problem-based learning, simulation stethoscope

INTRODUCTION

Inclusion of pharmacists as part of the healthcare team improves outcomes for patients with cardiovascular and reactive airway diseases.[1,2] Specifically, chronic obstructive pulmonary disease (COPD), heart failure, and hypertension are disease states for which pharmacist intervention has clearly demonstrated significant improvement in patient outcomes.[3-7] For these disease states, assessment is key to the proper selection and management of medications. Patient assessment is an organized and systematic approach to medication and disease state management that uses distinct techniques.

The Accreditation Council for Pharmacy Education guidelines, under Appendix B, include patient assessment as one element to be addressed adequately within the pharmacy college and school curriculum.[8] Additionally, the 2004 Center for the Advancement of Pharmaceutical Education specifies that curricular outcomes should include students being able to perform selected, appropriate physical assessment.[9] Thus, teaching physical assessment skills is considered an integral component of many pharmacy curricula.[10,11] Ninety-six percent of US pharmacy colleges and schools surveyed indicated that physical assessment skills are taught within their curricula, and 45% of those programs teach physical assessment as a stand-alone course.[10]

At the time of this research, there was no dedicated physical assessment skills course to teach techniques within the University of Mississippi curriculum, and skills were not consistently taught throughout the curriculum. Physical-assessment skills (eg, blood pressure measurement) taught during the second year of a doctor of pharmacy (PharmD) curriculum may require further refinement during subsequent years.[12] Students currently perform limited physical-assessment skills during their fourth year, obtaining individualized and independent instruction and evaluation from preceptors while on practice experiences. Relying only on practice experiences for skill instruction could produce inconsistent results and is less likely to lead to skill proficiency.[12] Physical assessment skills have been added to a series of skills laboratory courses in the first and second years. Because these skills had not been a formal part of the curriculum in previous years, third year students had no previous instruction on physical assessment skills. The lack of advanced physical assessment instruction during the third year offered an opportunity for implementing these skills more consistently throughout the curriculum. Longitudinal exposure to physical

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assessment skills throughout the curriculum could be beneficial.

The objective of this study was to evaluate the impact of implementing a physical-assessment learning experience into the PBL format of the third year at the University of Mississippi School of Pharmacy. The PBL format is a nationally recognized and well-documented method of teaching therapeutics, pharmaceutics, and pharmacokinetics used by several schools of pharmacy.[13-19] Unlike a faculty-centered model of teaching with lectures, PBL is a student-centered model of learning that organizes students into small groups with faculty facilitators. Pulmonary and cardiovascular components were the physical assessment topics chosen for this study because they are among the most commonly taught in pharmacy school.[12]

DESIGN

The third year of the PharmD degree program at the University of Mississippi School of Pharmacy concentrates on therapeutics in a PBL format. The Problem-based Learning Group course is conducted as small-group (7 or 8 students) case discussions with faculty facilitators. The PBL method of instruction allows for discussion that is conducive to case-based learning, a mechanism through which physical assessment courses are similarly taught.[12]

The physical-assessment learning experience sessions were implemented in April 2010 during the final 2 weeks of the last 8-week block of the Problem-based Learning Group course and focused on heart failure and chronic obstructive pulmonary disease (COPD). The author for each progressive disclosure case integrated physical assessment components into the cases and assisted in conducting the sessions. During the first PBL session of week 7, students completed a pre-experience survey instrument. During week 8, students attended a 1-hour session on physical assessment and completed 2 sets of post-experience survey instruments. With the consent of PBL course directors, the physical assessment learning experience session was incorporated as an educational activity in the class. The learning objective of this activity was to evaluate whether using a simulation stethoscope could enhance students' knowledge of physical assessment in a Problem-based Learning Group course.

A simulation stethoscope, Ventriloscope (Lecat's Ventriloscope, Canton, OH), was used to teach pulmonary and cardiac auscultation.[20] This device uses a wireless transmitter to play sounds stored as MP3 files on a sound card, allowing students to hear abnormal sounds in a simulated patient care setting. Three faculty members were trained on the simulation stethoscope and standardized teaching forms were created for the physical assessment sessions to ensure uniformity. The standardized forms and survey instruments incorporated details for the assessment of the pulmonary and cardiac systems.

Two faculty members conducted the 1-hour sessions for each PBL group (12 groups with 7 to 8 students per group). During the sessions, students were taught cardiovascular and pulmonary assessment techniques according to the standardized forms and identified unique auscultatory sounds using the simulation stethoscope. Each PBL group attending the physical assessment session was divided into 2 smaller groups, and a separate faculty member facilitated each subgroup. One faculty member covered the teaching form with each subgroup, while the other implemented the "hands-on" teaching session with the simulation stethoscope. The faculty members switched groups at the midpoint of each 1-hour session. Students were able to individually listen to the sounds using other students as simulated patients. As time allowed during the session, students also practiced taking blood pressure measurements using standardized stethoscopes and sphygmomanometers.

EVALUATION AND ASSESSMENT

All students completed a pre- and post-experience survey instrument (available from the author upon request). The pre-experience survey instrument consisted of 12 knowledge-based questions covering pulmonary and cardiovascular assessment techniques. Scores were graded and incorporated as a participation grade for the course. Six additional questions gauged students' confidence in their baseline knowledge and their interest in learning these techniques as part of the course. The post-experience survey instrument repeated the 12 knowledge-based questions from the pre-experience survey instrument and included 12 additional knowledge-based questions with similar content. The 12 additional knowledge-based questions were designed to determine whether students retained the material taught during the physical-assessment learning experience or simply remembered the questions from previous exposure. The post-experience survey instrument also included 7 questions designed to assess the following: student confidence with using physical assessment skills, interest in learning more during PBL classes, and whether use of the simulation stethoscope enhanced the learning experience. Confidence questions on the pre- and post-experience questionnaires were anonymous and based on a standard 5-point agreement Likert scale (Table 1). A section of the survey instrument was provided for student comments about this experience.

Although students completed the knowledge-based questions as a participation grade, they were not required

Table 1. Pharmacy Students' Responses to Confidence Questions Before and After a Physical Assessment Learning Experience (N = 92)[a,b]

	Pre-experience			Post-experience		
Survey Statement	Median	Mean	Score 4 or 5 (%)	Median	Mean	Score 4 or 5 (%)
I am confident that I can conduct a proper physical assessment exam for the respiratory system.	1	1.5	1.1	3	2.6	17.6
I am confident that I can assess the effectiveness of medication therapy for diseases of the respiratory system through physical assessment tools.	2	2.2	8.7	3	2.9	25.9
I am confident that I can conduct a proper physical assessment exam for the cardiovascular system.	2	1.7	1.1	3	2.6	14.1
I am confident that I can assess the effectiveness of medication therapy for diseases of the cardiovascular system through physical assessment tools.	2	2.3	13.2	3	2.8	20.0
I have the knowledge base necessary to assess the effectiveness of medication therapy for most disease states through physical assessment.	2	2.3	14.3	3	2.8	22.3
I would be interested in learning more physical assessment techniques during PBL classes.	4	3.6	65.2	4	4.0	76.5

[a] Responses based on a Likert scale on which 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.
[b] Some students did not respond to all survey statements.

to complete the Likert scale-based confidence and interest questions. Each student's score on the 12 baseline pre-experience knowledge questions was compared to the student's score on the 12 identical and 12 similar questions from the post-experience survey instrument using a Wilcoxon signed-rank test. Post-experience questionnaire responses also were compared using a Wilcoxon signed-rank test. The Likert agreement scale for the confidence questions was evaluated with descriptive statistics. This study was approved by the University of Mississippi Institutional Review Board.

All 92 students enrolled in the course in the third year were given the pre- and post- experience survey instruments during regularly scheduled case discussions. They also attended the 1-hour physical assessment sessions conducted separately from the scheduled case discussions during the eighth week of the last PBL block.

A 100% response rate was achieved for the knowledge-based questions. Students had an average raw score of 4.9 ± 1.4 (40.4% ± 11.4%) questions correct on the pre-experience knowledge-based questions. On the identical post-experience knowledge-based questions, the students' average raw score was 7.5 ± 1.7 (62.5% ± 13.7%). On the similar set of post-experience knowledge-based questions, students had an average raw score of 7.6 ± 1.4 (63.1% ± 11.6%). When each set of post-experience knowledge-based question scores was compared to the pre-experience knowledge-based question scores, the increase was significant ($p < 0.0001$). A comparison of the 2 sets of post-experience knowledge-based question scores did not show a significant difference ($p = 0.7115$).

Most students completed the Likert scale confidence questions on the pre- and post-experience survey instruments (89% and 84%, respectively). After the physical-assessment learning experience, 76.5% of students agreed or strongly agreed that they would be interested in learning additional physical assessment techniques during PBL classes, compared with 65.2% of students who gave the same responses on the pre-experience survey instrument (Table 1). The response rates for the pre- and post-experience survey instruments were 89% and 85%, respectively. On the post-experience survey instrument, 66.7% of the students agreed or strongly agreed that using the simulation stethoscope during the physical-assessment enhanced their learning experience.

Half of the students gave freeform input on enhancing PBL learning experiences with physical assessment techniques. While the freeform input was positive for the overall physical-assessment learning experience, respondents provided the following suggestions: 89% expressed a preference for either a longer period of time devoted to the experience, facilitation of the techniques earlier in the PBL program, or both.

The faculty resources used for implementation of the physical-assessment learning experience sessions overall were fairly minimal. Training faculty members with the simulation stethoscope and developing the standardized teaching forms took approximately 2 hours. Unfortunately,

only 3 faculty members were available to implement 12 physical-assessment learning experience sessions over a 1-week period. This was fairly intensive, given the short timeframe for implementing the sessions and the requirement for 2 faculty members to teach each PBL group.

DISCUSSION

This study evaluated the impact of implementing a physical-assessment learning experience into the PBL format of the third year of the PharmD curriculum. Responses on the post-experience survey instruments compared to the pre-experience survey instrument showed a significant increase in student knowledge after the 1-hour physical assessment session. There was no significant difference between responses on the 2 post-experience survey instruments, suggesting that improvement did not result simply from familiarity with the pre-experience questions but rather from an improvement in student knowledge regarding the underlying concepts of pulmonary and cardiovascular physical assessment.

Students completed questions measuring confidence according to a Likert agreement scale before and after a 1-hour physical assessment session. A higher percentage of students agreed that they were confident in their physical assessment skills related to the pulmonary and cardiovascular systems following the physical assessment sessions (76.5% and 65.2%, respectively), although significance was not measured. The median responses to pre-experience survey items related to student confidence with their physical assessment skills were either "strongly disagree" or "disagree." After the physical-assessment learning experience, the median responses were "neither agree nor disagree," suggesting that students felt slightly more confident to perform these skills after the session and that more time should be invested in teaching physical assessment skills at this point in the curriculum. On the pre- and post-experience survey instruments, most students stated that they would be interested in learning physical assessment during PBL classes (Table 1). The high rate of agreement on this question prior to the sessions suggests that students recognized the merit of integrating physical assessment into PBL even before they participated in the learning experience.

The pre-experience knowledge scores were lower than anticipated, reflecting that the participants had no previous formal training in physical assessment techniques. Following the physical-assessment learning experience, however, there was a significant increase in the scores on knowledge-based questions, showing that the brief, targeted exercise on pulmonary and cardiovascular assessment increased physical assessment knowledge among these pharmacy students. The small but significant improvement in knowledge scores after the experience suggests that expanded physical-assessment learning experience sessions could facilitate skill mastery, as shown in studies of curriculum-wide instruction in physical assessment skills.[12] In order to bridge this curricular gap more completely, the PBL Group course could be expanded to include assessment of vital signs, head, eyes, ears, nose, throat, diabetic foot, peripheral artery disease, and dermatological diseases, as well as to devote additional time to developing assessment skills related to the pulmonary and cardiovascular systems.

The simulation stethoscope, which realistically imitated irregular pulmonary and cardiovascular sounds, proved to be a useful tool for teaching physical assessment techniques. One advantage to using a simulation stethoscope was that it provided consistent abnormal cardiac and pulmonary sounds. Standardized patients, including trained actors, actual patients, or other pharmacy students, have been widely used to enhance teaching physical assessment skills and for objective structured clinical examinations (OSCEs).[21-23] Using standardized patients, however, can be limiting because they may not have physical abnormalities. Also, there is concern regarding consistency of experiences when using standardized patients.[24-26] Simulation mannequins do not have these inherent limitations and, therefore, have been used to successfully educate healthcare professionals.[27-30] However, because mannequins can be cost-prohibitive for many programs, use of the simulation stethoscope seemed to provide an economically feasible opportunity for students to hear cardiac and pulmonary sounds in a more real-world scenario. Students responded well to use of the simulation stethoscope during the physical-assessment learning experience, with a majority agreeing or strongly agreeing that it enhanced their learning experience.

The overall student view was positive toward increased facilitation of physical assessment techniques during future PBL sessions, but 2 important limitations of the current learning sessions were identified. First, a 1-hour session was not an optimal length of time for physical assessment training. The average percentage of correct post-experience knowledge questions for the pulmonary and cardiovascular systems was $<70\%$, suggesting that students may benefit from an increased amount of teaching time in the future and/or separation of the topics into segments focused on a single body system. Another limitation was the timing of the learning experience within the PBL program. Students felt that the insights they gained during the learning experience would have been useful for cases earlier in the PBL Group course; thus, earlier implementation may have been

more beneficial to the students' overall training. Use of the simulation stethoscope also had limitations. In some cases, the instrument's simulated sounds were muffled or indistinct. The instrument also required frequent recharging, which presented a problem when learning sessions were scheduled consecutively.

The findings of this study suggest that the simulation stethoscope could be a useful tool for teaching auscultative assessment of other disease states in a physical-assessment learning experience. It would be interesting to compare the use of the simulation stethoscope with that of other simulation tools, such as a mannequin. Based on this assessment, future research could focus on whether integrating targeted interventions using the physical-assessment learning experience format throughout the curriculum could help students master other assessment techniques as well.

CONCLUSION

Use of a simulation stethoscope in a physical-assessment learning experience increased students' knowledge in performing pulmonary and cardiovascular assessments. Future implementation of assessment techniques throughout the third year of a PBL course series may be beneficial for training students at the University of Mississippi School of Pharmacy.

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