INSTRUCTIONAL DESIGN AND ASSESSMENT

Integration of Physical Assessment Within a Pathophysiology Course for Pharmacy

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Objective. To determine first-year pharmacy students' analysis, confidence, and knowledge of patient physical assessment integrated within a pathophysiology curriculum.

Design. A prospective quasi-experimental study using validated pre- and post-surveys and follow-up examinations was conducted to objectively assess the confidence and knowledge of pharmacy students' physical assessment skills.

Assessment. Students' perceived ability to perform physical assessment techniques improved. Topic mastery was demonstrated by a final comprehensive examination with a composite student class score of 83%.

Conclusion. First-year pharmacy students demonstrated acquisition of patient physical assessment skills when integrated into a pathophysiology course.

Keywords: curriculum, patient assessment, physical assessment, pathophysiology

INTRODUCTION

Pharmacists' scope of practice has become and will continue to be more patient-centered because of the increasing demand for cognitive services related to specific disease states and medication therapy management.[1] Sustaining and growing these programs and services requires proper education of pharmacy students in order to emphasize confidence as a healthcare provider who is an integral part of the interprofessional healthcare team.[1] One way to achieve interprofessional care is to ensure student understanding of the medical model as it pertains to patient history, SOAP (subjective, objective, assessment, and plan) note development, and physical assessment.[2] This model has been recognized by the Accreditation Council for Pharmacy Education (ACPE), which indicates that a pharmacy student must be able to "provide patient care in cooperation with patients, prescribers, and other members of an interprofessional healthcare team based upon sound therapeutic principles and evidence-based data."[3] Additionally, the Center for the Advancement of Pharmaceutical Education (CAPE) outcomes for pharmaceutical care delineate that a student should be able to do the following: obtain necessary information from the patient, caregiver, and/or other members of the healthcare team, identify relevant information in the patient's profile or medical record; interview the patient or caregiver, employ effective communication strategies; identify the patient's complaint(s) and reason(s) for seeking medical care; and perform selected aspects of physical assessment, as appropriate.[4]

An ongoing question is where and how these pharmaceutical care competencies and outcomes should be integrated into the pharmacy curriculum. According to pharmacy student evaluations from the Medical College of Georgia, which assessed "confidence" and "perceived value" of physical assessment, students agreed that a physical assessment course taught in the second semester of the third professional year was valuable.[5] In a survey of pharmacy practice department chairs, Camara et al concluded that physical assessment improves communications with other healthcare practitioners, facilitates better understanding of total patient care, and is necessary for providing pharmaceutical care.[6] Spray and Parnapy's survey of pharmacy practice department chairs indicated that 96% of pharmacy schools teach physical assessment and 45% of physical-assessment courses stand alone.[7] A pedagogical and curricular consideration is to determine whether physical assessment should be taught as a standalone class or integrated into various curricular courses, such as pathophysiology, pharmaceutical care laboratory, and pharmacotherapeutics.[7] There currently is no standard of practice regarding when physical assessment should be introduced into the pharmacy curriculum.

This study evaluates 1 model of early professional program integration for patient history, SOAP note, and

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physical assessment, with a particular focus on the integration of physical assessment within a preexisting pathophysiology curriculum to meet ACPE pharmaceutical-care outcomes.[3] The study outcomes may demonstrate the importance of timing (ie, when to teach physical assessment) and integration of physical assessment. The practice-based nature of physical assessment and the knowledge-based nature of pathophysiology may improve the conceptualization and understanding of interprofessional education (ie, clinical diagnosing, therapeutics, and patient outcomes), which would enhance the "human dimension" to significantly improve learning.[8] Kinesthetic learning is a value-added instruction that physical assessment brings to a sometimes-tedious pathophysiology class. Given that physical assessment knowledge is necessary for providing comprehensive pharmaceutical care, the goal of this study was to evaluate students' subjective perceptions regarding physical assessment as well as their objective knowledge by analysis (eg, examination) when physical assessment is integrated into a pathophysiology course for first-year pharmacy students (P1s).

DESIGN

To address the greater emphasis of physical assessment as part of the pharmaceutical-care process, a curriculum change was made in 2008, moving physical assessment from a third-year pharmacy student laboratory classroom lecture to the first-year pathophysiology class (2 semesters of 4 credits each), when specific disease states are addressed. Within each semester, approximately 10 hours or five 2-hour lecture periods were devoted to physical assessment through the use of lectures, cases, and cooperative learning, all of which were taught by 1 faculty member with classroom lecture and hands-on training in physical assessment. In this institution, the physical assessment instructor has a doctor of pharmacy (PharmD) degree and masters in physician assistant studies (MPAS) and is a certified and practicing physician assistant. To promote a learner-focused environment, students (in groups of no more than 6) were required to practice physical examination techniques on each other. A set of instruments (ophthalmoscopes, otoscopes, and double-lumen stethoscopes obtained by college equipment funds) were provided for use during class. The physical-assessment topics covered over the 2 semesters entailed comprehensive health-history taking, SOAP-note development, and disease-specific assessment of the skin, head, neck, thorax, lungs, abdomen, and cardiovascular, musculoskeletal, and nervous systems.

As preparation, students were assigned required prelecture readings from *Bates' Pocket Guide to Physical Examination and History Taking*. The pocket version was selected because of its pertinent depth of information for pharmacy students and its portability for future use during clinical experiences. Lecture materials were derived from the Bates' physical examination textbook and instructor references. For example, prior to the pathophysiology lectures, which covered pulmonary diseases such as asthma and chronic obstructive pulmonary disease (COPD), the thorax/lung assessment was covered. Students practiced proper assessment and instrumentation on each other in order to determine normal physiologic findings related to inspection, palpation, auscultation and percussion. Auditory and visual computer programs, such as the Auscultation Assistant and the American College of Cardiology Foundation's *Heart Songs* CD, were used to expose students to adventitious physical findings. After completion of the instruction, students were expected to be able to identify the components of a comprehensive health history; describe physical examination techniques, including inspection, palpation, percussion, and auscultation; explain how to obtain accurate vital signs; apply physical examination techniques to specific body areas and systems; and describe the physiology or pathophysiology behind normal and abnormal physical examination findings. The overall outcome was the addition of objective measures of physical assessment to the subjective symptomatology of pathological processes to achieve a comprehensive evaluation of disease processes and monitoring.

The decision to integrate physical assessment into pathophysiology was made, in part, to meet ACPE criteria and to add a kinesthetic learning component to a class that many students find tedious. The hypothesis of the study was that formal physical-assessment instruction for P1s (experimental group) would improve attitudes and perceptions (eg, expectations, ability to perform, instruction, and training) compared with those of the control group, second-year pharmacy students (P2s).

EVALUATION AND ASSESSMENT

A physical assessment survey adapted from Bolesta, Longyhore, and Kang was used (with permission) to subjectively assess students' perceptions.[9] Survey questions consisted of 14 Likert-scale and multiple-selection questions, which addressed the use, value of instruction, knowledge, and confidence level associated with performing a physical assessment. Modifications of the survey were primarily semantic to reflect college-specific physical assessment and content to be taught within the pathophysiology curriculum. This survey was chosen after evaluation by an expert in the social and administrative sciences concluded that it demonstrated the greatest correlation with the current study's objectives. Surveys were disseminated to P1s prior to any formal college instruction in physical assessment (August 2008) and repeated the following year following classroom instruction (July 2009). Because there was no previous classroom instruction in physical assessment, P2s were administered the same survey at the same predetermined time intervals to serve as a control group. To facilitate data collection, surveys were distributed electronically by a university-sponsored data collection and analysis center. Surveys were administered on students' personal computers or campus computers. To increase participation, a reminder was sent electronically 2 weeks after the initial mailing and a final reminder after approximately 1 month. The online survey method removed personal identifiers during data collection and ensured confidentiality of subject responses and information. Only the researchers had access to the data and the results were reported in aggregate form (ie, means and standard deviations).

All statistical analyses were performed using Microsoft Excel (Redmond, WA). Descriptive statistics (mean, standard deviation, and percentage change) were used to summarize physical-assessment knowledge, instruction, and performance in the study population. *T* test statistics were used to calculate *z* scores, and their associated *p* values were used to determine differences in physical-assessment knowledge, instruction, and performance in the study population. Specifically, a paired-samples *t* test (one-sided) was used to calculate *z* scores for the objective outcomes (in-class examinations), and an independent-samples *t* test (two-tailed) was used to calculate *z* scores for the subjective outcomes (survey results). A significance level of $p < 0.05$ was used for all statistical analyses.

Pre- and post-survey response rates were 78% and 95% for P1s, respectively; and 58% and 96% for the P2s, respectively. The 3 questions solicited information for analysis related to student expectations, instruction and training, and ability to perform a physical exam. None of the pretest baseline parameters were significant (Table 1). From pretest to posttest, P1s' and P2s' expectation scores of physical assessment rose 15% ($p = 0.0004$) from 31% ($p < 0.0001$), respectively (Table 1). After receiving formal physical examination lectures, P1s reported higher ratings of instruction and training with scores increasing 18% ($p = 0.0061$) from 16% ($p = 0.0150$). After receiving formal physical examination lectures, P1s rated their ability to perform physical examination techniques higher with scores increased 14% ($p = 0.0384$) compared to P2s whose scores increased only 2% ($p = 0.7827$) (Table 2).

Objective measurements of students' physical assessment ability were obtained by the comprehensive final examination given to P1s at the conclusion of the semester. The examination was composed of 40 multiple-choice questions at the analysis, synthesis, or evaluation level. The content evaluated health history; SOAP-note development; physical-examination techniques; and specific evaluation of the thorax, lungs, and dermatologic and cardiovascular systems. To demonstrate subject mastery, the minimum acceptable score was arbitrarily designated at 70% or greater. The survey study design and informed consent were reviewed and approved by North Dakota State University's Institutional Review Board.

Composite examination scores for the respective physical assessment areas were as follows: health history, 83% ($p = 0.004$); basic physical assessment techniques, 97% ($p < 0.000$); SOAP note, 93% ($p < 0.000$); specific respiratory assessment, 78% ($p = 0.054$); dermatologic assessment, 85% ($p < 0.001$); and specific cardiovascular assessment, 81% ($p = 0.013$). The overall composite examination score of P1s for the comprehensive physical assessment was 83% ($p = 0.004$).

DISCUSSION

The hypothesis of the study was that formal physical-assessment instruction for P1s (experimental group) would improve attitudes and perceptions (eg, expectations, ability to perform, instruction and training) compared with those of P2s (control group). Patient history and SOAP-note development are learned concepts that promote interprofessional communication; however, the pharmacist's role and attitude in conducting physical assessment requires further clarification. Jones and Rospond defined patient assessment by pharmacists as ''the process through which pharmacists evaluate patient information (both subjective and objective) that was gathered from the patient and other sources and make decisions regarding: (1) the health status of the patient, (2) drug therapy needs and problems, (3) interventions that will resolve identified drug problems and prevent future problems; and (4) follow up to ensure that patient outcomes are being met. The primary focus of patient assessment is to identify, resolve, and prevent drug-therapy problems.''[10]

Many US pharmacy programs have approached education regarding physical assessment in a variety of ways, ranging from a standalone course to integration within courses.[6] Prior to this study, lectures in physical assessment were taught to P3s as part of the pharmaceutical care laboratories series. Because of our program's curriculum change in the fall of 2008 along with ACPE requirements, physical assessment was incorporated into the P1 curriculum as part of the pathophysiology class. With existing faculty loads, finances, and a rigorous pharmacy curriculum, a standalone course was not considered a wise use of resources for our college. Moreover, a department curriculum committee reviewed the integration

Table 1. Student Ratings of Their Expectations, Instruction, Training, and Ability to Perform Physical Assessment

Class	Pretest, Mean (SD)	Posttest,[a] Mean (SD)	% Change	*P*
Which of the following best describes the expectations for a practicing pharmacist in regards to physical assessment?[c]				
P1	2.9 (0.8)	3.3 (0.7)	15	0.0004
P2	2.8 (0.8)	3.7 (0.6)	31	< 0.0001
p	0.672	0.0002		
Which of the following best describes the formal physical assessment instruction and training you received?[b]				
P1	2.9 (0.8)	3.4 (0.9)	18	0.006
P2	2.6 (0.8)	3.0 (0.9)	16	0.015
p	0.109	0.008		
Which of the following best describes your ability to perform physical examination techniques based on the formal physical assessment instruction and training you received?[c]				
P1	2.6 (0.9)	2.9 (0.7)	14	0.038
P2	2.5 (0.9)	2.6 (0.9)	2	0.783
p	0.877	0.011		

[a] Significant differences found in posttest means between P1 and P2 students. A significance level of $p < 0.05$ was used for all statistical analyses.
[b] Means represent Likert-scale ratings of 1 = non-applicable, 2 = not important, 3 = neutral, 4 = important, and 5 = very important
[c] Means represent Likert ratings of 1 = poor, 2 = below average, 3 = average, 4 = above average, 5 = excellent, and 6 = no instruction

of physical assessment within the pathophysiology curriculum and found that the integration of physical assessment added to student's clinical knowledge of disease processes. This justified the resources for physical examination equipment and the allocation of one faculty member's time to teach the physical assessment portion of the curriculum.

Physical assessment practicum and laboratory are labor intensive. In a 1995 study, Longe suggested ways to manage this problem and predicted the use of "computer-assisted multimedia instruction" to deliver physical assessment education as 1 avenue for addressing this issue.[5] Initial funding for the technology infrastructure, however, is a barrier to implementation. Thus, integration of physical assessment into a preexisting course was the best use of current resources to meet increasing curricular demands. The rationale for integration of physical assessment within the pathophysiology course was to add a kinesthetic activity to enhance student learning. A study evaluating prehealth professional students taking a physiology course revealed that over half had multiple learning preferences when assessed using the visual, auditory, reading-writing, and kinesthetic (VARK) system.[11] On further analysis looking at prepharmacy vs premedicine, prepharmacy students had even stronger multilearning preferences. Integrating multiple learning preferences into 1 course may help students master lifelong professional skills. These skills can be evaluated and assessed when students participate in early and advanced practice experiences.

This curriculum change allowed for a transition period whereby the incoming P1s were the inaugural pathophysiology class with the integrated physical assessment. P2s completed pathophysiology during the previous year but without formal physical assessment training. Thus, this transition period (with a pre- and posttest) allowed for an assessment of formal physical assessment teaching/training.

Survey results identified that scores of P1s' expectation of physical assessment rose 15% and that P2s' scores rose 31% (Table 2). This outcome is naturally anticipated because of the greater knowledge base that P2s have over P1s as a result of having completed an extra year of pharmacy school. Thus, introductory pharmacy practice experiences (IPPE) courses that exposed P2s to physical assessment in clinical settings could have increased their expectations for their use of physical assessment.

When asked to rate their instruction and training in physical assessment (Table 2), P1s'scores rose by 18% and those of P2s rose by 16%. The P1s' baseline and posttest mean scores were higher than those of the P2s. The P1s' knowledge that they were going to be involved in a study during which they would receive physical assessment training may have given them more confidence. This higher confidence may explain their higher ratings of instruction and training, although the baseline means between the P1s and P2s were not significant ($p = 0.11$). Even though the difference in percent change was small (18% vs 16%), there was a significant difference in posttest scores between groups ($p = 0.0082$), while pretest differences were not significant ($p = 0.1089$). The significant outcomes for the P2s ($p = 0.0150$) could be attributed not only to IPPEs but also to completing a second year of pharmacy school (a maturation bias) while the P1s had completed only 1 year. More importantly, the significant outcome for the P1s ($p = 0.0061$) indicates a greater impact of physical-assessment instruction and leads to the conclusion that P1s favored the instruction they received.

The most salient finding is the self-rating on the ability to perform physical examinations (Table 2). P1s rated their ability to perform physical-examination techniques higher compared with P2s (14% vs 2%, respectively). This result validates the importance of teaching physical assessment and that pharmacy students who have received this training are more confident about their physical assessment abilities.

Student scores for perceived ability to perform physical assessment techniques rose by 14%. The perception of ability indicates confidence but does not demonstrate mastery of a subject. One way to demonstrate subject mastery is through the use of standardized patients, which was well accepted by pharmacists in a continuing education course on physical assessment.[12] Using patient-simulated mannequins to teach a performance-based pharmacotherapeutics course that includes written cases, hands-on education, and simulation of interactions between students and patients (mannequins) yields expertise and confidence.[13-15] Often, these teaching techniques require funds to pay for standardized patients as well as technology infrastructure. To evaluate subject mastery, students were assessed with a written examination that incorporated visual and auditory physical-examination questions with a minimum acceptable composite score of 70% or greater for physical assessment. The final comprehensive examination for fall 2008 demonstrated a mean composite student class score of 83% in physical assessment, thus demonstrating competency and retention of information. The current survey and examination results enhance and further validate that physical assessment skills can be advocated and incorporated early in the pharmacy curriculum.[5] This was demonstrated by the significant difference in percentage change from baseline between the P1s who received the integrated curriculum and the P2s who did not.

The overall educational outcome of adding objective measures of physical assessment to the subjective symptomatology of pathological processes to achieve a comprehensive evaluation of disease processes and monitoring was evaluated using the Pharmacy Curriculum Outcome Assessment (PCOA). The mean percentages of P1s who received the integrated physical assessment and pathophysiology curriculum were higher than the national average, whereas the P2s did not do as well, relatively or marginally. In pathophysiology, the P1s scored 64% compared with the national score of 59%. In patient assessment, the P1s scored 76% compared with the national score of 74%. As demonstrated by the PCOA score, the addition of physical assessment strengthened the pathophysiology curriculum, suggesting that this new model may be better than the previous one. Thus, based on these measures, acceptance by the faculty, and achievement of curricular standards, this model was judged to be effective at this institution.

Although patient physical assessment cannot be performed without the proper equipment, we argue that the instructor for patient physical assessment is the main and crucial educational resource and perhaps the most important for teaching patient physical assessment. The dual credentials and experiences of the instructor as a pharmacist and physician assistant demonstrate an interprofessional experience of both pharmacy practice and clinical care (physical assessment). Because not all pharmacists are qualified to teach physical assessment, a faculty member who is both a practicing pharmacist and physician assistant is a wonderful resource for P1s who receive hands-on clinical training in patient physical assessment in a pathophysiology course.

Possible limitations to the internal validity of this study include history, maturation, and selection bias. However, the multigroup design (P1s as the experimental group and P2s as the control group) of this quasi-experimental study controls for these threats and enhances the internal validity.[16] One possible external validity threat is the interaction of testing and treatment, whereby the pretest might influence the subject's sensitivity or responsiveness to the experimental variable. Another possible limitation that may threaten external validity is that group selection was predefined (P1 vs P2) rather than random. Replicating this study and achieving similar results would be the best indicator of generalizability, and we believe that this study is generalizable.

The results of this study substantiate the importance of exposure to and teaching of physical assessment earlier in the pharmacy curriculum because of the trend and standard of IPPE, which can involve direct patient contact in hospitals, clinics, and pharmacies.[17] We have several recommendations to begin or improve the integration of physical assessment into a pathophysiology courses, including having a competent and credentialed patient physical assessment instructor, appropriate integration of the material into the curriculum, acceptance by the faculty, and course assessment. Having a qualified and practicing instructor is crucial to the success of this type of integration, which also favors acceptance by the faculty and prepares the program for the curricular change. Finally, findings from formative and summative student evaluations can be used to continuously improve the course. Thus, such a model can be effective if appropriate these measures and continuous quality management assessments are implemented.

SUMMARY

Pharmacy students can obtain profession-relevant physical examination skills when integrated into a pathophysiology course. Moreover, this curriculum may improve the efficient delivery of courses. The value of high-quality physical assessment education and training for the pharmacist is undeniably crucial in a fast-evolving healthcare environment. Physical assessment skills are vital for pharmacy students to excel in their profession. This study's successful integration of physical assessment and pathophysiology resulted in an efficient use of resources that created a model for pharmacy colleges to consider.

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