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Jackie Ho
Touro University California

Monica K. Bidwal
Touro University California, monica.bidwal@tu.edu

Ingrid C. Lopes
Touro University California, ingrid.lopes@tu.edu

Bijal M. Shah
Touro University California, bijal.shah@tu.edu

Eric J. Ip
Touro University California, eric.ip@tu.edu

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INSTRUCTIONAL DESIGN AND ASSESSMENT

Implementation of an Accelerated Physical Examination Course in a Doctor of Pharmacy Program

Jackie Ho, PharmD/MPH Candidate 2015, Monica K. Bidwal, PharmD, Ingrid C. Lopes, DO, Bijal M. Shah, BPharm, PhD, and Eric J. Ip, PharmD, BCPS, CSCS, CDE, FCSHP

Touro University California College of Pharmacy

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Objective. To describe the implementation of a 1-day accelerated physical examination course for a doctor of pharmacy program and to evaluate pharmacy students' knowledge, attitudes, and confidence in performing physical examination.

Design. Using a flipped teaching approach, course coordinators collaborated with a physician faculty member to design and develop the objectives of the course. Knowledge, attitude, and confidence survey questions were administered before and after the practical laboratory.

Assessment. Following the practical laboratory, knowledge improved by 8.3% ($p<0.0001$). Students' perceived ability and confidence to perform a physical examination significantly improved ($p<0.0001$). A majority of students responded that reviewing the training video (81.3%) and reading material (67.4%) prior to the practical laboratory was helpful in learning the physical examination.

Conclusion. An accelerated physical examination course using a flipped teaching approach was successful in improving students' knowledge of, attitudes about, and confidence in using physical examination skills in pharmacy practice.

Keywords: physical assessment, physical examination, patient assessment, curriculum design, flipped curriculum

INTRODUCTION

Pharmacists in primary care work to improve patients' access to and quality and continuity of care through disease management and drug cost optimization.[1] Motivated to meet the demands of a primary care shortage, pharmacists have expanded their care roles to include some form of physical assessment, the most common being vital sign measurements.[2] A comprehensive physical assessment skill (head-to-toe physical examination) would be vital to pharmacists for the following reasons: (1) to enable a complete and accurate patient evaluation (ie, monitor response to drug therapy), (2) to provide comprehensive patient care, (3) to heighten acceptance by patients and the health care team, (4) to enhance interdisciplinary training and interprofessionalism, and (5) to advance professionally (ie, gain prescriptive authority). As new legislation, such as California's pharmacy provider status bill (SB493), affords pharmacists more opportunities to provide services directly related to patient outcomes, pharmacists may find themselves lacking certain skills related to physical assessment to deliver comprehensive patient care. To address this challenge, some colleges and schools pharmacy have enhanced their curriculum to teach physical examination as part of their physical assessment training.[3-9] Studies have found that pharmacist-led instruction and the use of simulation stethoscopes are effective in teaching physical examination skills to pharmacy students.[5,6] To date, no study has explored instructional strategies to implement an accelerated course in physical examination.

The Accreditation Council for Pharmacy Education, Center for the Advancement of Pharmaceutical Education, and American Association of Colleges of Pharmacy list physical and patient assessment as essential curricular content for the doctor of pharmacy degree.[10,11] Ninety-six percent of US doctor of pharmacy (PharmD) programs surveyed indicated teaching some physical assessment skills (eg, vitals and lung and heart sounds), with 45% of these programs having a stand-alone physical assessment course.[3] However, the proportion of schools that teach a head-to-toe physical examination as part of their physical assessment curriculum has not been evaluated.

Prior to fall 2013, the Touro University California College of Pharmacy (TUCOP) physical assessment training was similar to that of many schools of pharmacy in that it was limited to measuring vital signs (eg, blood pressure, heart rate, temperature, and respiratory rate) and

Corresponding Author: Monica K. Bidwal, 1310 Club Dr, Vallejo, CA 94594; Phone: (707) 638-5904. Fax: (707) 638-5959. E-mail: monica.bidwal@tu.edu

performing lung auscultation, mini-mental status examinations, and diabetic foot examinations. To further enhance the curriculum, the college decided to institute training of a formal comprehensive physical examination, and, in September 2013, implemented a 1-day accelerated physical assessment skills course that incorporated aspects of a full general physical examination (including head, ears, eyes, nose, throat, neck, respiratory, cardiovascular, gastrointestinal, and musculoskeletal systems). By teaching a full physical examination, TUCACOP has expanded on the physical assessment training offered by most other schools of pharmacy in the nation.[3]

Currently, most pharmacy education literature describes efforts to redesign existing physical assessment instruction for pharmacy students but only one study describes how to implement a physical examination course within a PharmD program.[4-9] Longe described the implementation of a 3 credit-hour physical assessment course that met 5 hours per week.[8] To date, no study has described the implementation of an accelerated physical examination course with the use of multimedia and the flipped teaching method or evaluated the effectiveness of such a course for pharmacy students. Describing the instructional strategy in implementing an accelerated course may be beneficial for pharmacy colleges that do not currently have the complete head-to-toe physical examination as part of their physical assessment training and for programs that may not have the resources, time, or capability to implement a full stand-alone, semester-long course.

DESIGN

Two pharmacy practice professors, 3 pharmacy students, and 1 physician faculty member collaborated to develop comprehensive objectives, relevant topics, and learning materials (eg, videos) for the accelerated physical examination course. Learning objectives emphasized practical physical assessment skills likely to be performed by pharmacists in various care settings (eg, community, ambulatory care, and acute care settings).

Vital signs (eg, blood pressure, heart rate, respiratory rate, temperature) assessment and training were emphasized previously in the first week of pharmacy school, as these skills are most commonly used by pharmacists and were taught most often in other schools of pharmacy.[3]All pharmacy faculty members who taught the physical examination course received a 5-hour training session on physical examination led by the physician faculty member.

The accelerated physical examination course was a practical laboratory within the introductory pharmacy practice experience (IPPE) program, a 4-semester-long series that allowed students to practice the knowledge, skills, and attitudes necessary to become competent pharmacists in actual pharmacy settings. This course was offered to first-year pharmacy students (P1s) in the fall semester and second-year pharmacy students (P2s) in the spring semester. As the study was a presurvey and postsurvey design implemented in the spring semester, the study population consisted only of P2s who had not yet taken the physical examination course.

The course consisted of 2 components: self-study (prior to practical laboratory) and hands-on training (during the practical laboratory). Several teaching strategies were used throughout the course including videos, lectures, demonstration of technique, and audio files. Employing the flipped teaching method, students were required to review learning materials (eg, videos, reading assignments) at home prior to coming to the practical laboratory for the hands-on portion of the course.[12]

Learning materials consisted of an hour-long training video detailing each component of a full physical examination and the significance of physical findings, as well as a chapter from Tietze's *Clinical Skills for Pharmacists: A Patient-Focused Approach.*[13] A 30-minute video giving a brief overview of how to complete a full physical examination along with an instruction was also provided. Videos were developed by TUCACOP faculty members and pharmacy students.

At the start of the practical laboratory session, students were given a pre-experience knowledge quiz based on physical examination material reviewed prior to the laboratory. Following the quiz, students were surveyed regarding their attitudes about and confidence in performing a physical examination. After completing the 5-hour practical laboratory, students were given a postexperience survey to assess attitudes and confidence levels. Postexperience knowledge level was assessed in a comprehensive therapeutics examination roughly 3 weeks after the laboratory. This study was approved by the Touro University California Institutional Review Board.

For the practical laboratory, students were instructed to dress comfortably, preferably in loose clothing (eg, shorts and t-shirts) to make practicing the physical examination more convenient. The pharmacy class of 95 students was divided randomly into 2 groups (n=46 and n=49, respectively). Separate days were chosen for the 2 groups to attend the practical laboratory to ensure adequate student-to-preceptor ratio and to accommodate for space. At each session, there were 7 stations consisting of groups of 8-9 students. Stations were divided into body systems and each station lasted 40 minutes, except the first and second stations, which lasted 20 minutes each. Physical examination instruction sheets outlining the 7 stations were given to students prior to the practical laboratory. Each station was led by 1-2 trained pharmacy faculty members, who instructed on both days of the laboratory.

Each station began with a brief 5-10 minute introduction on how to perform the examination, using students as model patients and explaining how examination findings (normal vs abnormal) can apply to drug therapy management and pharmacy practice. The following 15-30 minutes were used to practice the skill on fellow classmates. Instructors observed students to ensure proper assessment techniques were used. Abnormal findings (such as abnormal lung sounds) were demonstrated through audio recordings. Details of each station and equipment/supplies used can be found in Table 1.

EVALUATION AND ASSESSMENT

A pre-experience knowledge quiz consisting of 8 multiple-choice and fill-in-the-blank questions was administered just before the practical laboratory and was used to assess whether students completed the prelaboratory assignment (watching the video and reading the assigned chapter). Roughly 3 weeks after the course, 5 postexperience knowledge questions, similar to those in the pre-experience knowledge quiz, appeared in a therapeutics examination. The postexperience knowledge questions were designed to assess how well students retained material taught during the course. Although all students were required to complete the pre-experience and postexperience knowledge-based questions for their course grade, students were not required to complete the pre-experience and postexperience survey.

The anonymous presurvey and postsurvey instrument used questionnaires modified from similar pharmacy education physical examination studies.[4-6,14] The pre-experience survey consisted of 5 demographic, 7 attitude, and 25 confidence questions. The postexperience survey questions consisted of the same presurvey attitude and confidence questions and 11 additional attitude questions. Confidence and attitude elements appeared in the form of 5-point Likert scale-type questions.

Survey responses were entered into Excel 2010. Only completed surveys were included in the final analysis. Descriptive statistics (mean, standard deviation) were reported for continuous data (eg, knowledge scores, unique attitude questions). Identical Likert scale-type questions from pre-experience and postexperience surveys were matched and analyzed using the paired-sample *t* test. Statistical analysis was conducted using STATA (College Station, TX) with a 95% confidence interval. All *p* values were 2-sided and considered significant if ≤ 0.05.

The pharmacy class surveyed consisted of mostly Asian (75.0%) and Caucasian (14.1%) females (70.7%) with an average age of 26.9 years. Before this course, most students (92.4%) had no prior instruction in conducting a physical examination.

A 100% response rate was achieved for knowledge-based questions. Students' knowledge significantly improved by 8.3% ($p<0.0001$) with an average pre-experience knowledge score of 79.8% ± 14.8% and postexperience knowledge score of 88.1% ± 12.7%.

Of the 95 students in the P2 class, 92 (96.8% response rate) completed both the presurvey and postsurvey questions on confidence and attitudes. After the physical examination course, students' attitudes toward the importance of physical assessment in pharmacy practice ($p<0.01$) and their perceived ability to perform a full physical examination ($p<0.0001$) significantly improved, while interest level in learning to perform a full physical examination remained the same (73.9%) (Table 2).

Furthermore, 93.5% of students strongly agreed or agreed that they had a greater understanding of how physical assessment techniques can be used to evaluate drug therapy. Overall, students felt that reviewing the training material (91.3%) and reading material (67.4%) prior to the practical laboratory was helpful in their understanding and performance in the physical examination course (Table 3). After the course, students' confidence significantly improved ($p<0.0001$) in performing various physical examination techniques, identifying abnormal findings and

Table 1. Station Breakdown and Equipment/Supplies Used in the Accelerated Physical Examination Course

Station		Duration	Equipment Used*
1	General observation, head, neck, ears, mouth	20 min	Pen light, tongue depressors
2	Eyes	20 min	Pen light
3	Respiratory system	40 min	Stethoscopes, lung sounds†
4	Cardiovascular system: pulses, capillary refill, turgor, pitting edema, heart, carotid arteries	40 min	Stethoscopes
5	Gastrointestinal system	40 min	Stethoscopes, drapes
6	Neuromuscular system I: gait, range of motion, flexibility, strength	40 min	None
7	Neuromuscular system II: reflexes, sensation, motor, hearing	40 min	Reflex hammer

Note: Vital sign assessment skills were emphasized earlier in the curriculum, prior to this physical examination course

* Hand sanitizers and alcoholic swabs were available at each station

† Lung sounds (normal vs abnormal) was demonstrated via www.easyauscultation.com/lung-sounds.aspx

Table 2. Attitudes Toward Physical Examination Skills Before and After the Practical Laboratory (n=92)*,†

	Pre-experience		Postexperience		
Survey Statement	**Mean (±SD)**	**Score of 4 or 5 (%)**	**Mean (±SD)**	**Score of 4 or 5 (%)**	***p* value†**
Head-to-toe PA skills are important in pharmacy practice	3.5 (1.1)	59.8	3.9 (1.1)	72.8	< 0.01
Interested to learn how to perform a full physical examination	3.9 (1.2)	73.9	4.0 (1.1)	73.9	NS
Do not need to perform physical examination because I have access to information from other health care professionals	2.8 (1.1)	23.9	2.9 (1.1)	27.2	NS
Have the knowledge to assess the effectiveness of medication therapy for most disease states through PA tools	3.2 (1.0)	42.4	3.8 (0.8)	71.7	< 0.0001
Able to use appropriate medical terminology and abbreviation while gathering and analyzing information	3.5 (0.9)	62.0	4.0 (0.6)	83.7	< 0.001
Able to recognize common medical terms and abbreviations	3.8 (0.7)	78.3	4.1 (0.6)	89.1	< 0.01
Comfortable performing head-to-toe PA on a patient	2.5 (1.1)	20.7	3.9 (0.9)	73.9	< 0.0001

Abbreviations: PA=physical assessment; SD=standard deviation, NS=Not significant

* Responses based on a Likert scale of 1 to 5, where 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

† A significance level of $p \leq 0.05$ was used for all statistical analyses

discussing these findings with other health care professionals (Tables 4-5).

DISCUSSION

The accelerated physical examination course using a flipped teaching approach was successful in improving students' physical examination knowledge and improving their attitudes about and confidence in using these skills in pharmacy practice. Improved confidence in discussing physical and diagnostic findings with other health care professionals can facilitate interprofessional collaboration and communication.

Table 3. Elements and Advantages of the Flipped Classroom Approach and Success of the Physical Examination Course (n=92)*,†

	Postexperience		
Survey Statement	**Mode**	**Mean (±SD)**	**Score of 4 or 5 (%)**
Reviewing the training video prior to the practical laboratory was helpful in my understanding and performance in the course	5	4.4 (0.7)	91.3
Being assessed with a quiz before the hands-on training was helpful in my understanding and performance in the course	4	3.7 (1.1)	62.0
Reading material prior to the practical laboratory was helpful in my understanding and performance in the course	4	3.9 (0.9)	67.4
Hands-on training reinforced concepts learned in the training video	5	4.7 (0.5)	96.7
After this course, I have a greater understanding of how PA techniques can be used to evaluate drug therapy	5	4.4 (0.7)	93.5
After this course, I feel I am more equipped to determine which patients should seek medical care than before I attended this class	4	4.2 (0.8)	83.7
This course successfully taught me the basics in PA techniques	5	4.4 (0.7)	88.0

Abbreviations: PA=physical assessment; SD=standard deviation

* Responses based on a Likert scale of 1 to 5, where 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

† A significance level of $p \leq 0.05$ was used for all statistical analyses

Table 4. Confidence in Performing and Identifying Physical Examination Elements Before and After the Course (n=92) *,†

	Pre-experience		Postexperience		
Technique	**Mean (±SD)**	**Score of 4 or 5 (%)**	**Mean (±SD)**	**Score of 4 or 5 (%)**	***p*-value†**
Perform Physical Examination Techniques					
Heart sounds	2.9 (1.1)	35.9	4.1 (0.9)	78.3	< 0.0001
Lung sounds	2.6 (1.1)	22.8	4.0 (0.9)	73.9	< 0.0001
Bowel sounds	2.5 (1.1)	18.5	3.9 (0.9)	67.4	< 0.0001
Deep tendon reflexes	2.7 (1.1)	23.9	4.1 (0.9)	82.6	< 0.0001
Range of motion	3.0 (1.2)	38.0	4.5 (0.6)	95.7	< 0.0001
Monofilament	3.8 (1.1)	71.7	4.3 (0.8)	89.1	< 0.0001
Mini-mental status examination	2.8 (1.1)	26.1	3.6 (1.1)	56.5	< 0.0001
Identify Physical Examination Findings					
Normal heart sounds	2.8 (1.1)	25.0	4.1 (0.9)	80.4	< 0.0001
Abnormal heart sounds	2.5 (0.8)	7.6	3.6 (1.1)	59.8	< 0.0001
Abnormal lung sounds	2.6 (1.0)	16.3	3.8 (0.9)	57.6	< 0.01
Abnormal bowel sounds	2.3 (0.8)	5.4	3.6 (1.0)	55.4	< 0.0001
Signs of ascites	2.9 (1.1)	33.7	4.0 (0.9)	72.8	< 0.0001
Signs/symptoms of Parkinson's	3.1 (1.0)	42.4	4.2 (0.7)	87.0	< 0.0001
Signs and symptoms of stroke	3.3 (1.0)	50.0	4.1 (0.7)	85.9	< 0.0001
Loss of peripheral sensation	3.1 (0.9)	38.0	4.2 (0.7)	88.0	< 0.0001

Abbreviations:SD=standard deviation, NS=Not significant

* Responses based on a Likert scale of 1 to 5, where 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

† A significance level of $p \leq 0.05$ was used for all statistical analyses

After the course, there was a significant improvement in the students' confidence to perform physical examination techniques and identify abnormal physical findings. Although the pre-experience survey indicated the majority of students did not have prior formal training in physical examinations, there was a significant improvement in comfort level when performing a head-to-toe physical examination on a patient after the course. These results show that the 1-day accelerated course was successful in improving confidence and comfort level in physical examination techniques performed on multiple body systems. Although knowledge scores demonstrated retention of information roughly 3 weeks after the course, assessment of skill level in an objective structured clinical examination (OSCE) at least 1 month after the practical laboratory may be able to provide more salient information on how this course can impact long-term retention of material, competency, and skill mastery in physical examination performance.

At the end of the course, the majority of students indicated that the 1-hour training video and reading assignment were helpful in their understanding of and performance in the course. The high pre-experience knowledge score could be attributed to the flipped teaching method used. The results suggest that reviewing material, especially a video, prior to the practical laboratory

Table 5. Confidence in Communicating with Health Care Professionals Before and After the Course (n=92)*,†

	Pre-experience		Postexperience		
Survey Statement	**Mean (±SD)**	**Score of 4 or 5 (%)**	**Mean (±SD)**	**Score of 4 or 5 (%)**	***p* value†**
Interpret PA findings in patient's medical record	3.5 (1.0)	57.6	4.1 (0.6)	88.0	<0.0001
Recognize and interpret laboratory values and diagnostic tests in a patient case	3.9 (0.8)	77.2	4.2 (0.6)	90.2	<0.01
Discuss patient's laboratory values and diagnostic findings with other health care professionals	3.6 (0.9)	56.5	4.1 (0.7)	82.6	<0.0001
Discuss PA findings with other health care professionals	3.2 (1.0)	40.2	4.0 (0.7)	80.4	<0.0001

Abbreviations:PA=physical assessment; SD=standard deviation

* Responses based on a Likert scale of 1 to 5, where 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree

† A significance level of $p \leq 0.05$ was used for all statistical analyses

was helpful in improving students' understanding and productivity during the hands-on training. For future prelaboratory assignments, it may be worthwhile to assess if other multimedia resources, such as sound files (eg, lungs, heart), may also enhance students' learning, productivity, and competency during laboratory sessions.

The majority of students responded that this physical examination course successfully taught them how physical assessment can be used to evaluate drug therapy and that physical assessment (including a comprehensive physical examination) was an important aspect of pharmacy practice. Bolesta et al found that students who were taught by pharmacy instructors reported higher physical assessment skill use in pharmacy practice compared to students taught by nursing instructors.[5] As all our students were taught by pharmacy faculty members, it would be intriguing to evaluate how this course would affect students' use of physical examination techniques in advanced pharmacy practice experience (APPE), specifically in the community, ambulatory, and acute care settings.

As a result of this course, pharmacy students reported feeling more confident in discussing physical examination findings, laboratory values, and diagnostic findings with other health care professionals. Although our study did not specifically evaluate the effect of physical examination training on enhancing interprofessionalism among pharmacy students, trained pharmacy students would likely be able to communicate and collaborate more effectively regarding physical assessments with other health care professionals.

Overall, students viewed the physical examination course as positive and relevant to pharmacy education, but multiple limitations must be addressed. First, this study was based on a single pharmacy school class. Future studies may wish to assess the impact of an accelerated physical examination course on students from multiple pharmacy schools. Next, our study did not assess long-term retention of physical examination knowledge. Future studies could reassess physical examination knowledge later in the curriculum (ie, at the end of the academic year or prior to starting APPEs). Next, while our study assessed knowledge, it did not assess hands-on competency, which can more accurately assess a students' knowledge and skill level. Plans to assess physical examination competency are currently underway. Lastly, as most students were healthy or had no abnormalities, it was difficult to practice identification of abnormal findings on classmates. Confidence in identifying abnormal findings of the lungs and heart may be enhanced with the use of a simulation mannequin or stethoscope.[6,9]

The 1-day accelerated physical examination course was effective and efficient in expanding the physical assessment portion of the curriculum. The multimedia flipped teaching approach enhanced students' knowledge, attitudes, and confidence during the hands-on practical laboratory. Additionally, this approach enabled efficient use of in-class time and resources. With the passage of California SB493 in 2013, pharmacists gained provider status with increased roles in managing patients with chronic diseases.[15] Physical examination skills and the ability to communicate physical examination findings with other health care professionals will become more important for pharmacists in upcoming years. Improved knowledge, attitudes, and confidence in physical examination will enhance interprofessional communication and will prepare future pharmacists for advance pharmacy care roles.

SUMMARY

A one-day accelerated physical examination course, using a flipped teaching approach and multimedia resources, was successful in improving students' knowledge of, attitudes about, and confidence in using physical examination skills in pharmacy practice. Improved confidence in communication with other health care professionals was also observed.

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