A Comparison of Physicians and Ultrasound Technologists as Instructors for a Point-of-Care Ultrasound (PoCUS) Course: A Pilot Study

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ABSTRACT

Background - Considerable research exists demonstrating the value of ultrasound education at both the undergraduate and post-graduate level. Several barriers to ultrasound education have been reported, including instructor availability. Notably, a gap in the literature exists on solutions to overcome these barriers. Currently, no literature exists on the use of ultrasound technologists as instructors for ultrasound curriculum. The aim of this study is to determine if ultrasound technologists can assist the delivery of point-of-care ultrasound (PoCUS) curriculum to undergraduate medical students as determined by learner evaluations.

Methods - An interactive PoCUS course was offered to first-year undergraduate medical students at Memorial University of Newfoundland. The course was taught by three instructors certified by the Canadian Emergency Ultrasound Society and one experienced ultrasound technologist. Participants (n=12) rated instructors on a Likert-scale according to knowledge of PoCUS, ability to answer questions effectively, ability to provide quality feedback and overall effectiveness of instruction. The participants were also asked to provide qualitative feedback regarding how having an ultrasound technologist as an instructor enhanced their learning.

Results - There were no significant between-group differences for instructor ratings on knowledge of PoCUS, ability to answer questions effectively, ability to provide quality feedback or overall effectiveness of instruction. All of the participants agreed that having an ultrasound technologist as an instructor enhanced their learning, especially with respect to techniques for image generation.

Interpretation - The results of this pilot study suggest that ultrasound technologists are non-inferior to physicians in their ability to teach PoCUS to undergraduate medical students. These findings support our hypothesis that ultrasound technologists can assist the delivery of PoCUS curriculum to undergraduate medical students.

INTRODUCTION

Considerable research exists demonstrating the value of medical ultrasound education at both the undergraduate and postgraduate level (1–4). The Royal College of Physicians and Surgeons and The College of Family Physicians of Canada Emergency Medicine Program identify PoCUS as a core competency (5). More recently, the Canadian Internal Medicine Ultrasound (CIMUS) Group released a statement in support of PoCUS training as part of the Internal Medicine residency program (6).

Several barriers to ultrasound education have been reported such as access to machines, limited space in curriculum, financial limitations and a lack of qualified instructors (7–10). Notably, a gap in the literature exists on solutions to overcome these barriers. Currently, there are no published studies on the use of ultrasound technologists as instructors for medical ultrasound education. Ultrasound technologists are specialists in ultrasound image generation, who perform a high volume of examinations and have a comprehensive knowledge of cross-sectional anatomy. Their expertise is likely unparalleled in this field and, as instructors for medical ultrasound education, technologists could promote more efficient use of financial resources when compared to physician instructors.

The aim of this study is to determine if ultrasound technologists can assist the delivery of a PoCUS workshop to undergraduate medical students, as well as to assess how medical trainees perceive the effectiveness of ultrasound technologists as instructors.

METHODS

Study Design

A PoCUS session was offered to first year medical students at Memorial University of Newfoundland. The session was taught by four instructors- one instructor who is an experienced ultrasound technologist and three instructors certified by the Canadian Emergency Ultrasound Society. A Standardized Patient was assigned to each of the four stations. To standardize the delivery of the course content, the ultrasound technologist completed a training session with an experienced PoCUS instructor prior to the study. The technologist was asked to adhere to the principles of PoCUS. A list of objectives for this session was provided to all instructors (Table 1).

Table 1. Learning objectives for PoCUS session offered to first year medical students at Memorial University of Newfoundland

1. Become familiar with the US machine and how to generate a basic US image.
2. Build on knowledge gained in the PoCUS Introductory Lecture.
3. Generate an image of the kidney in the longitudinal plane.
4. Identify major features of renal architecture.
5. Generate an image of the abdominal aorta in the transverse plane using the spine shadow as a landmark.
6. Distinguish between the aorta, the IVC, and other vessels/structures on an ultrasound scan.
7. Demonstrate how to measure the diameter of the aorta.
8. Generate an image of cardiac activity in the subxiphoid plane.
9. Identify the four heart chambers, interventricular septum and pericardium.
10. Generate an image of the thyroid.
11. Identify both lobes of the thyroid, the isthmus and the tracheal rings.
12. Identify the carotid, jugular and internal jugular veins.
13. Identify the lung tissue and lung sliding.

Study Participants

A total of 12 first year medical students at Memorial University were recruited for this study. All participants had previously attended a didactic lecture on Introduction to ultrasound.

Study Treatment

Participants were randomly assigned to one of the four stations so that there was never more than a 2:1 student to instructor ratio per station. Students rotated through each of the

four stations. Each student had 90 minutes of practice time in total. A voluntary, post-study questionnaire was completed by all participants. Participants were asked to rate instructors on a Likert scale from 1-10 according to 1) knowledge of PoCUS 2) ability to answer questions effectively 3) ability to provide quality feedback 4) overall effectiveness of instruction. Participants were asked whether or not having an ultrasound technologist as an instructor for this session enhanced their learning and if so, why (Table 2).

Statistical Analysis

Quantitative data was compared using the Wilcoxon matched-pairs test for non-parametric data. A p value of < 0.1 was selected for statistical significance. All numerical data are presented as the mean $\pm$ standard deviation. The margin of equivalence for this study was set as $\pm$ 1 student-rated point. A thematic analysis was performed on the student comments from the qualitative feedback section.

RESULTS

Student Ratings of Instructors

There was no significant difference in mean student ratings for knowledge of PoCUS when physician instructors (9.58 ± 0.51) were compared to the ultrasound technologist instructor (9.33 ± 0.77; $p=0.25$) (Figure 1A).

There was no significant difference in mean student ratings of ability to answer questions effectively between physician instructors (9.5 ± 0.67) and the ultrasound technologist instructor (9.5 ± 0.67; $p=0.50$) (Figure 1B).

There was no significant difference in mean student ratings for ability to provide quality feedback when the physician instructors (9.58 $\pm$ 0.51) were compared to the ultrasound technologist instructor (9.50 $\pm$ 0.67; p=0.50) (Figure 1C).

The mean rating for overall effectiveness of instruction in the physician group (9.58 $\pm$ 0.51) was not significantly different when compared to the technologist instructor (9.50 $\pm$ 0.67; p=0.50) (Figure 1D).

The mean difference in scores between the two groups, for each of the student-rated criteria, were within the 1- point margin of equivalence (Figure 2).

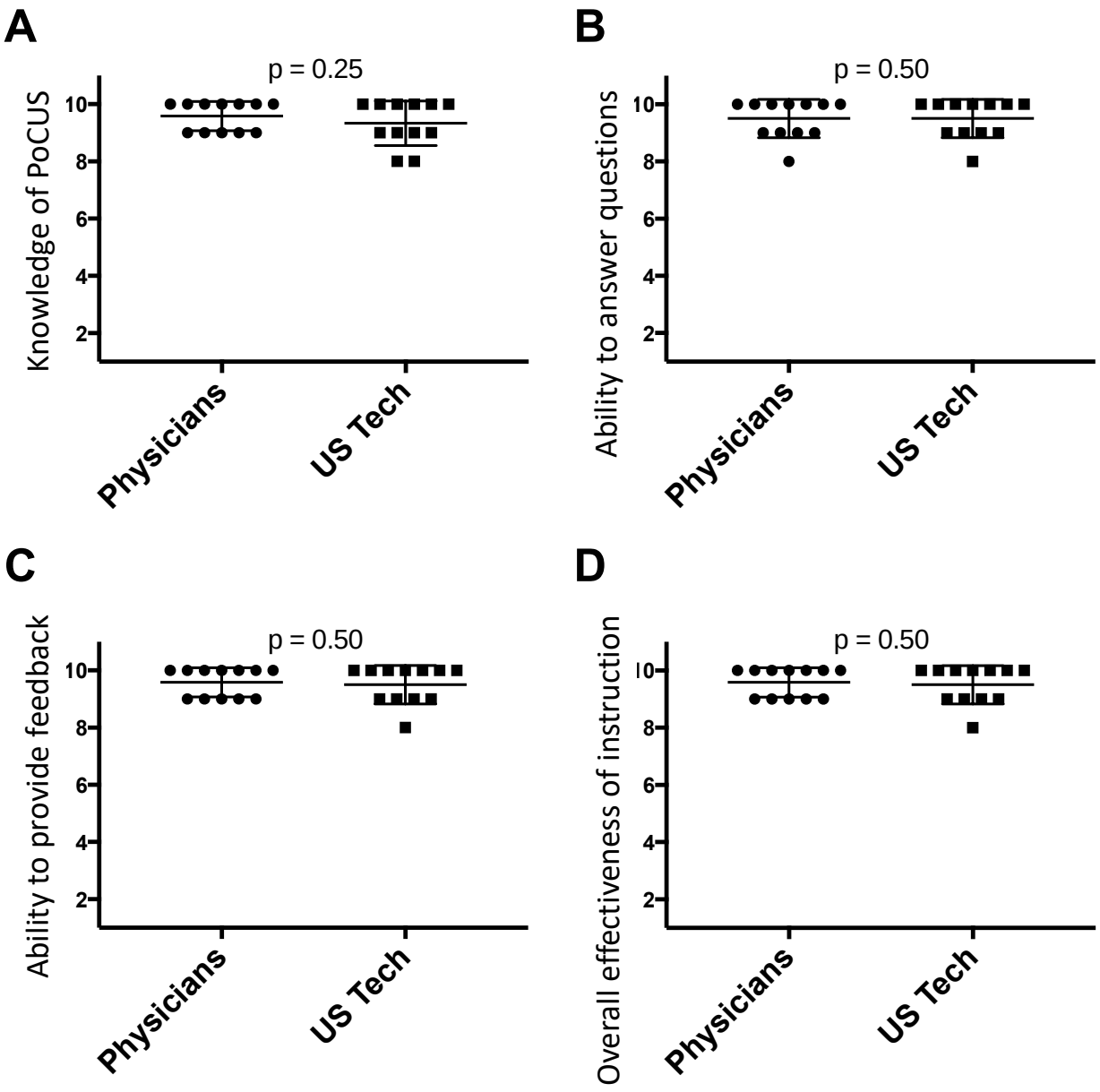

Figure 1. First year medical student's ratings of physicians versus ultrasound technologist as instructors for a PoCUS session

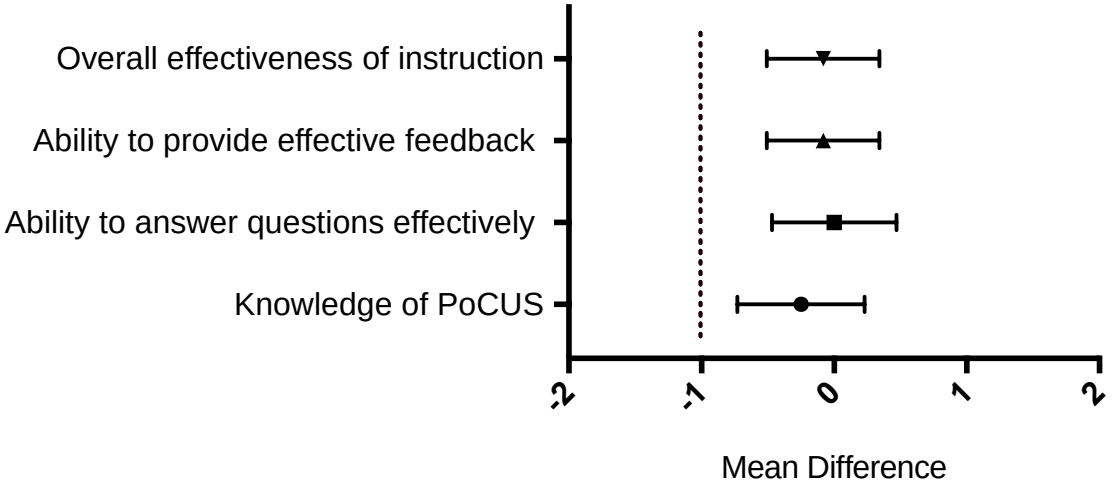

Figure 2. Mean differences in student-rated scores of physicians versus ultrasound technologist as instructors for a PoCUS course

Qualitative Feedback

All of the participants indicated that inclusion of an ultrasound technologist in this session enhanced their learning. Eight participants (66%) provided feedback when asked to explain their reasoning for this. Four of the responding participants (50%) referred to the "technique" used by the ultrasound technologist, specifically with respect to image generation. The participants noted that the technologist instructor had "great techniques for getting clear images", which "were different than the physicians". Three students (37.5%) stated that the "knowledge" possessed by the technologist enhanced this session. One student (12.5%) commented on "comparability to physician instruction" and that the technologist provided "similar instruction to physician instructors- likely more familiar with equipment". Finally, one participant (12.5%) referred to "experience" of the ultrasound technologist (Table 3).

Table 3. Thematic analysis from qualitative student responses as to why having an ultrasound technologist as an instructor enhanced learning during a PoCUS session

Theme	**n (%)**
Technique *I. Image generation*	4 (50)
Knowledge	3 (37.5)
Comparability to physician instruction	1 (12.5)
Instructor Experience	1 (12.5)

DISCUSSION

In this study, we compared physicians to ultrasound technologists in their ability to teach a PoCUS course to first year medical students. There were no significant between-group differences in knowledge of PoCUS, ability to answer questions effectively, ability to provide quality feedback or overall effectiveness of instruction. In terms of their teaching ability, ultrasound technologists were shown to be non-inferior when compared to physician instructors.

We previously suggested that ultrasound technologists could assist the delivery of PoCUS curriculum as they are specialists in ultrasound image generation. The qualitative data received from the student responses supports this idea. We suggest that ultrasound technologists provide a different yet useful perspective, especially with respect to techniques for ultrasound image generation.

One of the limitations of this study was the small sample size. For future studies, a power analysis will be performed to determine an appropriate sample size. In addition, our study had only one ultrasound technologist instructor in the experimental group. Also, since we did not compare ratings between physicians, there were no previous studies on which to base the assigned margin of equivalence. Finally, the results of this study may not be generalizable to a postgraduate medical population, and a future study is necessary for assessing if more advanced learners would benefit from having ultrasound technologists as PoCUS instructors.

In conclusion, this study suggests that ultrasound technologists are non-inferior to physicians as instructors for a hands-on ultrasound course delivered to undergraduate medical

students. We suggest that ultrasound technologists provide a different yet useful perspective to assist the delivery of PoCUS curriculum to medical undergraduate students.

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