Author's response to reviews

Title: Effectiveness of an Ultrasound Training Module for Internal Medicine Residents

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Version: 3 Date: 16 August 2011

Author's response to reviews: see over
August 16, 2011

RE: Effectiveness of an Ultrasound Training Module for Internal Medicine Residents
(MS: 1321888435349276)

Dear Dr. Jones,

We appreciated the reviewers’ careful attention to our manuscript. We made many revisions based on the reviewers’ helpful suggestions, and the manuscript is now much improved.

Attached you will find the reviewer comments followed by our responses. Thank you for your time and consideration. We look forward to hearing from you. We are happy to consider further revisions if recommended.

[Signature]

Corresponding Author
Assistant Professor of Medicine
Reviewer: Paul Lombardo
Reviewer's report:

Major compulsory revisions
• nil.

Minor essential revisions
I. Abstract:
   a. Paragraph 3; need to define what is meant by ‘appropriate use’ of ultrasonography.

   We acknowledge that the use of “appropriate” is vague and therefore it was deleted from the sentence.

   b. Paragraph 5; remove comma after ‘effective’ in first sentence. Cite references to support statements made in the first sentence.

   The comma was removed as instructed.

   Regarding the first sentence, the wording was modified in order to avoid making assumptions about internal medicine programs.

   c. Paragraph 5; final sentence needs to define what is meant by ‘effectively using ultrasound’.

   The word effectively was deleted as this study was only able to assess the comfort level of the residents and did not evaluate knowledge or observed performance.

   d. A clear statement of a hypothesis (which is actually not stated but referred to later in the methods) would be useful in this section, for example, “…ultrasound training will increase the confidence of residents in using ultrasound to guide invasive procedures”. In addition, the possible benefits of increasing residents’ confidence in using ultrasound such as increasing accuracy, decreasing procedure time, decreasing complications, improving patient/resident interaction etc could be mentioned.

   We agree with the suggestion. A hypothesis statement was added to the introduction in paragraph 5. The following statements were added: “Our hypotheses are as follows: i. training residents in the use of ultrasound to perform clinically relevant procedures are feasible and will improve their ability to perform procedures during their training; ii. Improved ultrasound use will lead to less procedure related complications and enhanced patient safety.”

II. Methods:

• The ultrasound equipment used in the training and procedures needs to be specified.
The following machines were used during this workshop: SonoSite Titan with a C15 4-2 MHz transducer; SonoSite Micromaxx with C60e 5-2 MHz and L25e 13-6 MHz transducers; SonoSite S series and SonoSite M-Turbo with a C60x 5-2 MHz transducer.

III. Results:
• Paragraph 1; ratings cited in the results section relating to survey questions 2, 4 and 5 are not included in Table 1.

• Table 1 could include findings from questions 2, 4 and 5, or another table created to display the extra information. We intentionally did not include these questions in the table because the questions were not asked on both pre-survey and post-survey. Therefore comparisons of pre- and post data on these questions were not possible.

IV. Methods:
a. Paragraph 1; Fellows would certainly be appropriate to teach the medical side of paracentesis and thoracentesis. It is unclear what ultrasound instrumentation training these people would have, but I wonder whether a sonographer (technologist) would be better qualified to teach ultrasound equipment optimisation?

Dr. Anjali Bhagra, a board certified radiologist from overseas taught the ultrasound equipment and use of ultrasound. Critical care fellows teaching thoracentesis are trained in proper use of ultrasound guided thoracentesis through their training.

b. The amount of teaching time to learn image optimisation and ‘knobology’ appears very limited. This may be related to the functionality of the ultrasound system used in the study. It is doubtful that anything more than a rudimentary introduction to ultrasound physical principles and instrumentation can be achieved in this time. An objective measure of the residents’ understanding is not tested and it may be that any increase in confidence is misplaced.

We agree with your critique of our study. We have acknowledged the limitation of the subjective aspect of assessing the impact of the ultrasound workshop in the limitations section in the discussion. We agree that the brief duration is limiting and it would be more effective to perform regular brief overview with an opportunity to practice the skills of ultrasound guided procedures with real patients.

V. Discussion:
a. Paragraph 1; It could be argued the major reason the largest improvement in confidence rating was in indentifying the internal jugular vein and thyroid gland is because these are very simple structures to identify on ultrasound. Conversely, peritoneal structures are very difficult to indentify on ultrasound. It would therefore be expected that a very basic training course would produce these outcomes.

This is definitely a possibility. More importantly however, the internal jugular vein and thyroid gland were identified on resident volunteers with the advantage of being able to position the
volunteers appropriately and also the advantage of visualizing flow on the ultrasound. Peritoneal structures are more difficult to assess in a cadaver and likely would have been easier in a real life patient.

b. Paragraph 2; Self-reported confidence ratings do not provide an objective measure of residents understanding or skill as the authors point out. Self reported confidence can clearly be misplaced. The value of this study should be emphasized more, that is, list the advantages of having residents that are confident in adopting technology (in this case ultrasound) to assist them in their current and potentially future work.

The learning lessons from this study were highlighted as suggested.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Needs some language corrections before being published

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**
• I declare that I have no competing interests.

### #2 Reviewer's report

**Title:** Effectiveness of an Ultrasound Training Module for Internal Medicine Residents

**Version:** 2 **Date:** 6 July 2011

**Reviewer:** Marilyn Baird

**Reviewer's report:**

Discretionary revisions

1 Given medical ultrasound is far more operator dependent than other medical imaging modalities, 40 minutes of theory and 20 minutes of practice seems a very short period of time for practitioners new to the modality to learn how to manipulate the controls, optimise data acquisition sequences and so on. Thus I think it is important the authors provide specific information regarding the ultrasound machines used during the delivery of the ultrasound training module.

If portable machines with a range of pre-set protocols were used this should be stated to assist readers to understand the reason for the lack of in-depth technical training in the module. The transfer of learning is always maximised when the equipment used in a training setting replicates the equipment found in regular clinical use. Therefore it could be useful to readers planning to replicate the study to know if the machines used in the training module were the same as those
currently in use by qualified internal medicine specialists in the clinic where the study took place.

This was suggested by reviewer #1 and information regarding the type of ultrasound equipment was added to the manuscript.

2 The second sentence of the Method section states the workshop was “led by subspeciality fellows, staff and senior medical resident volunteers”. Again, for the benefit of readers seeking to emulate the educational approach, I think the authors should state how the resident volunteers were recruited and mention if any processes were in place for situations where an unsuspected abnormality might be detected during such a training session. Finally, who comprised the “staff” referred to in the statement? Given their obvious technical expertise, were the staff sonography technologists? If these experts were not employed, the authors might care to say why they were not asked to assist in the delivery of the course.

We agree that it is important to provide ample description of how the study was carried out in order to promote replication. Regarding workshop station leaders, chief medical residents from the internal medicine residency send personalized letters of invitation to senior critical care and gastroenterology fellows from the Mayo clinic Rochester programs asking for participation. This takes place 6 months prior to the workshop to ensure adequate number of educators present during the workshop. For our ultrasound workshop, we had the advantage of Dr. Bhagra’s radiology experience. For that reason, a sonographer was not used. This can be replicated in other institutions with the help of an experienced sonographer with a clinician or a radiologist.

3 it appears 76 interns completed the training module which comprised 80 minutes of “hands-on” practice. Clearly students were required to rotate around a variety of stations however it is not clear how much time individual students spent at each station performing the various tasks. Perhaps I am missing something but what was the total amount of time spent in delivering the “hands-on” practical element of the module given the size of the cohort? Again, this clarification may be helpful for others who seeking to replicate the training module.

There was a total of 120 minutes in the workshop. Everyone participated in the initial 40 minutes of didactic session delivered by Dr. Bhagra. The following 80 minutes was divided into one 20 minute session for identification of internal jugular vein and thyroid on resident volunteers followed by three 20 minutes stations and the residents rotated through each of the stations every 20 minutes. In order to ensure small number of student to educator ratio, there were two stations set up in order to allow no more than three residents per station at a time. There were two stations dedicated to thoracentesis and led by critical care fellows; two stations dedicated to paracentesis and led by gastroenterology fellows, and two stations led by Dr. Bhagra, one for peritoneal cavity and one for assessing pleural space and lung.
4 Do the authors have any explanation for the discrepancy between the numbers of participants who completed the pre-intervention survey and those who completed the post-intervention survey?

The main reason there was a difference between the number of residents who filled out the pre-survey and those who filled out the post-survey is the fact that the surveys were optional but the workshop itself was mandatory. Another possibility is the fact that the workshop took place towards the end of the orientation weeks (2 weeks total) and residents were likely more fatigued and less interested in staying later in the day to fill out the survey. The pre-survey was given at the beginning of the day and the post-survey was given at the end of the day after the workshop was completed.

Level of interest: An article whose findings are important to those with closely related research interests

#3 Reviewer's report

Title: Effectiveness of an Ultrasound Training Module for Internal Medicine Residents

Version: 2 Date: 15 July 2011

Reviewer: Mary Lawson

Reviewer's report:
This was a clearly presented research study. The authors have clearly attempted to design a study that has practical application to their area and they should be commended for their efforts. The abstract is clear and succinct and provides an accurate summary of the work conducted. The introductory section is excellent and provides a good contextualisation of the previous relevant research and the current study context.

-Thank you.

The methods are clearly described. A diagrammatic representation of the study design would be very helpful (discretionary revision but would be very helpful!). The authors have used self-reported confidence as their outcome measure. They demonstrate some appropriate caution with the interpretation of the results. They acknowledge in their discussion that they didn’t have an objective measure of skill. This is entirely appropriate but could also be enhanced by referral to the extensive literature that demonstrates a lack of correlation between confidence and competence. Equally, some mention of the potential dangers of over-confidence (if associated with a lack of skill) in terms of a potential inability to self-limit in clinical practice. This counters the argument that the training provided would contribute to patient safety and so it would be an important point for the authors to address in their discussion.

Diagrammatic representation of the study design was done and will be attached as a supplement.
I am very unsure about and totally unfamiliar with the use of the term “Knobology”. Is this a colloquialism and, if so, its use should be avoided.

The word Knobology is a term used in ultrasound education for machine controls. Due to unfamiliarity, it was removed as suggested.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**
I declare that I have no competing interests