CORRESPONDENCE

Remote solutions for telementoring point-of-care ultrasound echocardiography: The RESOLUTE study

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To the Editor,

Point-of-care ultrasound (POCUS), which has revolutionised patient assessment, traditionally relies on the availability of a skilled operator to acquire and interpret images. Although the relevant declarative knowledge needed to perform POCUS is generally available (e.g., medical literature, web-based videos), teaching the required psychomotor skills is challenging without the physical presence of an instructor. Telementoring is a novel, evolving technology in medical education that permits remote instruction of a skill through video-conferencing. We sought to demonstrate that the psychomotor skills required to perform cardiac POCUS can be acquired through telementoring.

After institutional ethics review approval (REB 20160814-01H), 33 intensive care unit nurses with no previous sonography training were recruited. Participants interacted with a high-fidelity transthoracic echocardiography simulator (VIMEDIXTM; CAE Healthcare, Ville St-Laurent, QC,

Canada) connected via REACTSTM video conferencing software to a remotely located instructor (R.C.). Following a video-conferenced instructional period, each participant was remotely guided to obtain five standard POCUS views. The simulator was then randomized to one of four pre-set pathologies (anterior myocardial infarction, cardiac tamponade, dilated cardiomyopathy, ventricular fibrillation). The instructor then remotely guided the participant to obtain the views required to diagnose the underlying pathology. Both the subject and instructor were blinded to the pathology.

To facilitate psychomotor instruction, two web cameras provided vantage points for the instructor to assess the probe's position. Instruction of cardinal movements was simplified by colour-coding the probe. Additionally, we utilized the feature of REACTSTM software that allows the instructor to overlay a pointer (red dot) on the live-feed to direct probe placement on the mannequin (Figure).

The instructional period needed to orient participants took a mean (SD) of 142 (40) sec, and the time required to obtain the five standardized POCUS images was 324 (116) sec. The remote instructor subsequently required 84 (49) sec to guide the participants through a focused POCUS examination and obtain a diagnosis of the underlying pre-set pathology.

The acquired loops were subsequently reviewed by two experts (S.M., B.H.) who rated them using a previously validated scale for assessing POCUS image quality.¹ Using the rapid assessment of competence in echocardiography score, both reviewers judged that more than 90% of the echo loops were of sufficient quality for basic image interpretation (scores were ≥ 3), and each correctly identified 32 of 33 cardiac pathologies.

We acknowledge that this simulator study has limitations, but we believe that the demonstration that psychomotor skills can be telementored has important

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Figure A) Simulator setup with the VIMEDIX simulator webcam 1 on a mannequin and webcam 2 on an ultrasonographic image. B) Zoomed view of a shared REACTS screen from a video-conferencing

laptop shows an interactive pointer (red dot). C) Colour-coded probe. D) Instructor setup with shared REACTS screen and mock colour-coded probe for reference

implications. In the hands of an inexperienced clinician, POCUS could be of limited use or even detrimental to the patient's health, resulting in misdiagnoses due to the acquisition of inadequate images or to their misinterpretation. If guided by a remote expert, however, these risks may be reduced because little or no previous experience is required by the operator. Acquisition of POCUS-relevant psychomotor skills via telemetry also permits remote instruction, thereby reducing travel time and cost for the trainee. This is particularly relevant in a vast country such as Canada, where remote areas may have limited access to medical experts. Telementoring can also facilitate follow-up after a workshop if troubleshooting is required.

Future studies are needed to substantiate the generalizability of our work. Using actual patients would assess real-world applicability and would undoubtedly reveal new challenges to remote psychomotor instruction.

Telementoring could also be studied in patients undergoing other types of POCUS examinations or for procedures involving complex psychomotor skills such as regional anesthesia.²

Conflicts of interest None declared.

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