ABTRACT TITLE: VIRTUAL COACH CAN BE EQUIVALENT TO A HUMAN INSTRUCTOR IN REBOA TRAINING: A PROSPECTIVE RANDOMIZED STUDY

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Background/Introduction: Engberg et al. described the need for an assessment tool for procedural competency supported by validity evidence to advance research in resuscitative endovascular balloon occlusion of the aorta (REBOA) training[1]. To increase access to training, we developed a virtual coach for simulator-based REBOA mastery training and evaluated whether the virtual coach (VC) is equivalent to a human instructor (HI).

Methods: Using the System of Modular Mixed and Augmented Reality Tracking Simulators (SMMARTS) software development kit[2], we developed a REBOA simulator with electromagnetic tracking of the needle tip, catheter, and ultrasound probe[3] allowing real-time tracking of ultrasound-guided femoral arterial access. We integrated a VC to autonomously teach and assess learners. We conducted a validation study in a university hospital. Consenting surgery residents with no experience placing REBOA were randomized into either HI (n=7) or VC (n=7) groups using a random number table and took the Guay Visualization of Views Test to assess spatial ability. After didactic training with a prerecorded video, the first two attempts at REBOA placement were recorded as the baseline measurement. Then, hands-on, curricular training was given by either HI or VC. Participants then did free practice until they felt ready for mastery assessment. Mastery standards[4] were to complete consecutive successful REBOA insertions in Zone 1 then Zone 3 within 2 minutes, while scoring 14/14 on critical actions. Mastery assessment allowed unlimited attempts until mastery was achieved. The primary objective was to compare VC vs. HI using the metrics of time and number of attempts to reach mastery, and mean score at mastery evaluation. Secondary objectives included pre- and post- survey comparisons. Demographics were reported as frequency, median, and mean±SD, categorical data were compared using the χ^2 test, and the Mann-Whitney U test was used for pairwise comparisons of continuous data using SPSS.

Results: Fourteen participants completed all study-related interventions and achieved mastery. There was no statistically significant difference in demographic data between groups (Table 1). None passed the baseline evaluation for either time or critical actions (Table 1). VC and HI groups showed similar results based on the mastery evaluation (i.e., no difference between groups; Table 1). There was no statistically significant difference between VC and HI groups in the pre- and post-study survey results ($p>0.05$, χ^2 test), except for the simulated probe ($p=0.02$, χ^2 test). 97% of the participants commented positively about the training in the post-study survey.

Conclusion: This validation study showed that our mixed reality simulator was efficacious for the REBOA training. VC performed similarly to a HI in teaching participants in placing a REBOA catheter on the REBOA simulator.

References: 1. Injury. 2020; 51: 147–56. **2.** Simul Healthc. 2021;16: 353–61. **3.** The Center for Safety, Simulation and Advanced Learning Technologies, University of Florida. 2021. https://simulation.health.ufl.edu/technology-development/augmented-reality-mixed-simulation/reboa-simulator/ **4.** Acad Med. 2015; 90:1495–500.

Table 1. Human Instructor vs. Virtual Coach Group Comparisons

Parameter	**Human Instructor (n=7)**	**Virtual Coaching (n=7)**	**Total (n=14)**	**p**
Age - Median (min-max)	31 (28-33)	33 (29-36)	31 (28-36)	0.157*
Sex - (Female/Male)	5/2	3/4	8/6	0.280**
Guay Visualization of Views Test score Median - (min-max) – (Maximum score is 24)	16 (13-23)	17 (10-24)	16 (10-24)	0.898*
Number of attempts to reach mastery during mastery assessment Median - (min-max)	4 (2-9)	2 (2-6)	4 (2-9)	0.128*
Free practice attempts - Median (min-max)	1 (0-3)	1 (0-6)	1 (0-6)	0.425*
Baseline time (seconds) - (Mean±SD)	268.4±193.8	243.4±144.0	255.9±168.0	0.613*
Baseline success in allotted 2 minutes for each attempt	0	0	0	NA
Mastery times (seconds) - (Mean±SD)	99.6±10.7	104.6±9.9	102.1±10.4	0.223*
Total scores - (Mean±SD)	10.1±4.3	9.72±4.8	9.91±4.5	0.702*
*: Mann-Whitney U test, **: χ^2 test, SD: Standard deviation				