The educational impact of a formalized RUSH (Rapid Ultrasound in Shock) protocol in emergency medicine residency ultrasound training

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INTRODUCTION

Point-of-care ultrasound for undifferentiated hypotension is an important tool for Emergency Physicians. The RUSH Exam outlines a systematic approach to hypotension and an approach to the type and cause of shock. An educational model using RUSH was developed for Emergency Medicine (EM) residents. This study evaluated the module in a simulated setting on the following endpoints: improvement in image acquisition, interpretation, speed, and subjective comfort level.

P Among Emergency Residents with basic ultrasound training

I Will training in RUSH using 8 hour didactic and small group sessions

C Compared to basic ultrasound skills acquired in residency

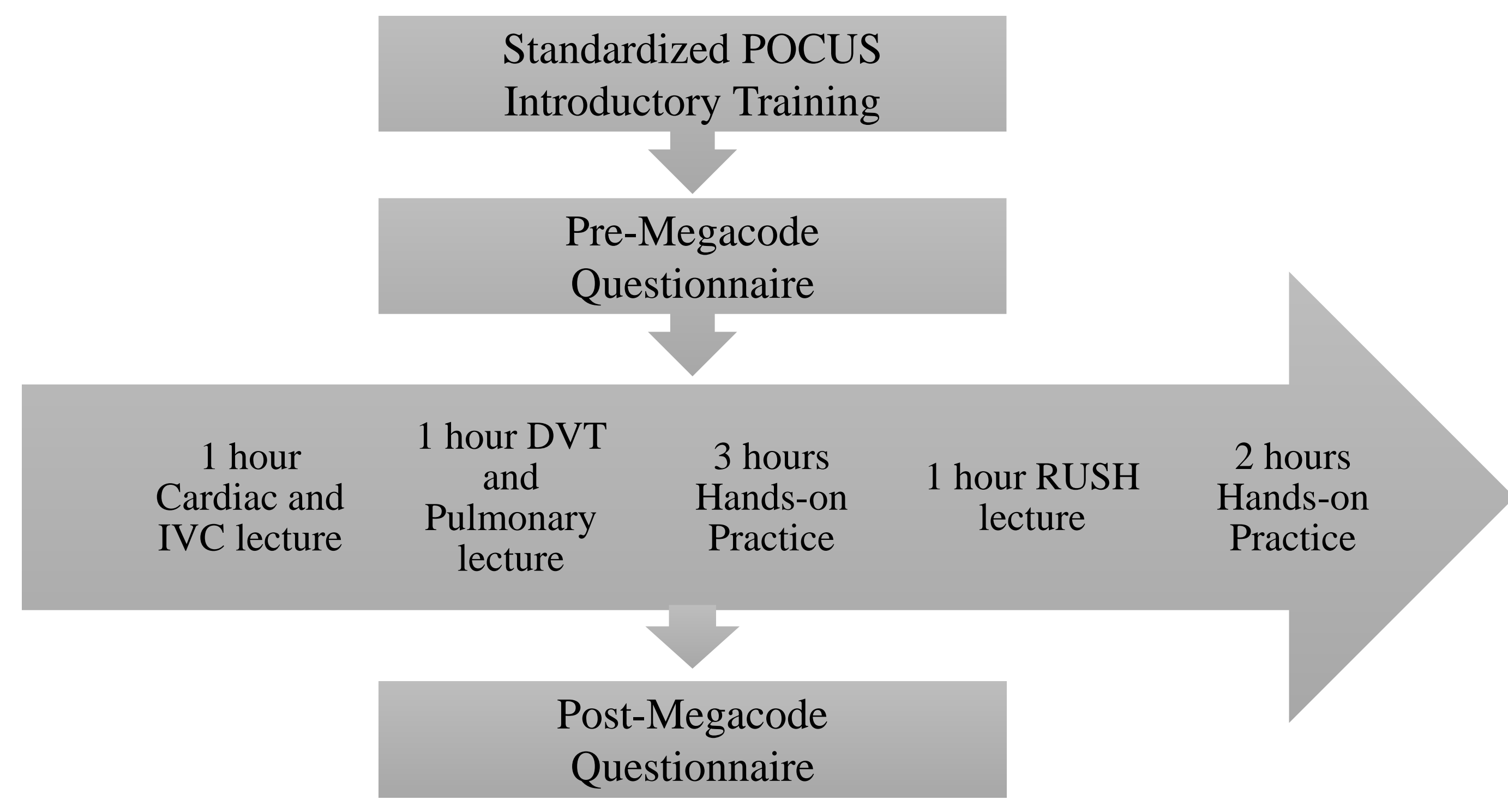O Result in improved image acquisition, interpretation, speed, and subjective comfort level

RUSH

PUMP
- Pericardial effusion
- LV contractility
- RV dilation

TANK
- IVC
- Pleural effusions, pneumothorax
- Abdominal fluid
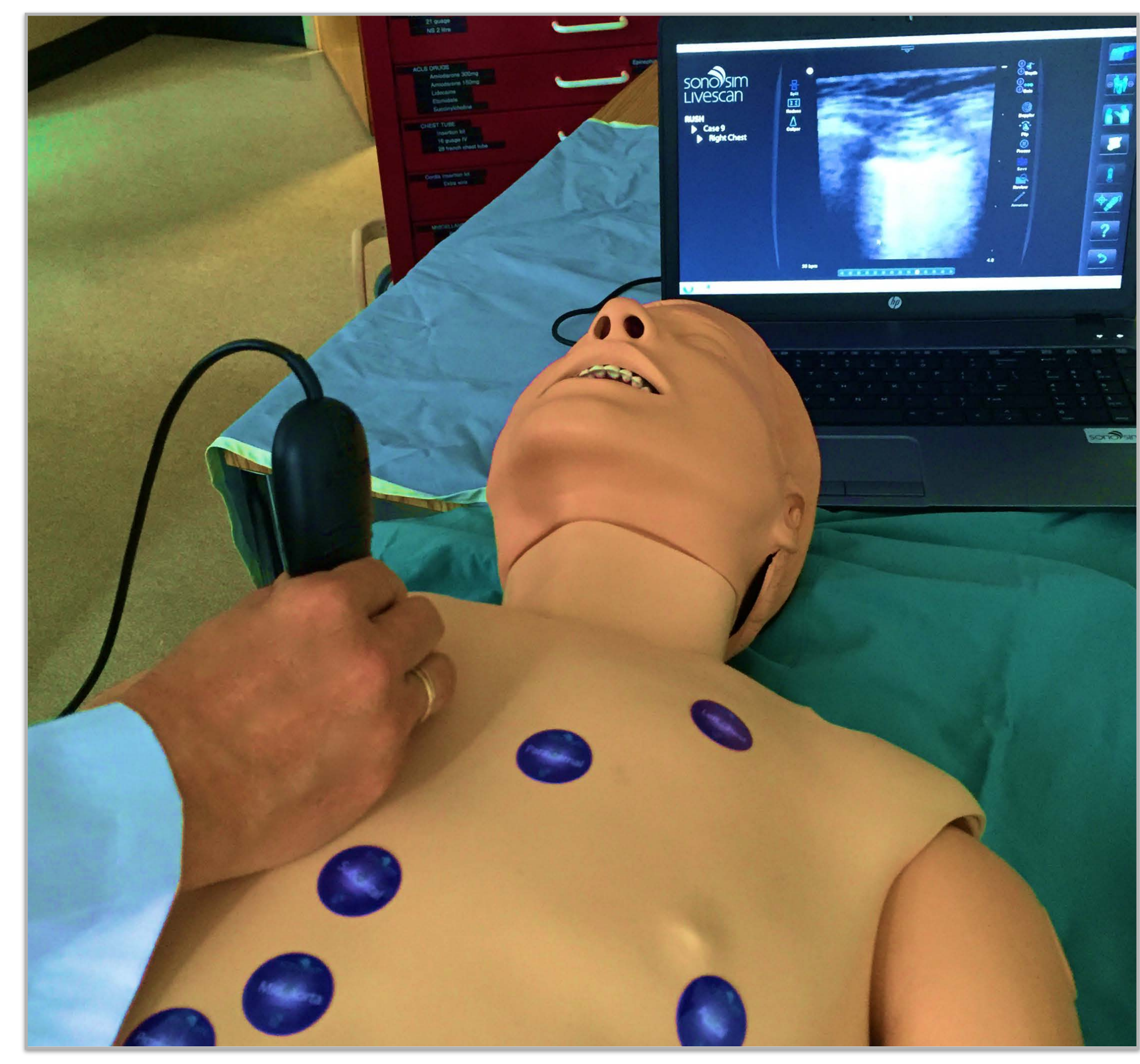
PIPES
- Aortic aneurysm
- DVT
- Dissection*

*Dissection was not covered

METHODS

Ethics board approval was obtained for this before and after simulation study. Residents in the FRCPC-EM/CCFP-EM Programs from July 2014 to July 2015 were eligible. Participants were excluded if they were unable to complete all portions of the module or if they did not consent. All residents received the same level of point-of-care ultrasound (POCUS) introductory training prior to implementation of the RUSH intervention. The 8-hour intervention included RUSH didactic and hands-on small group sessions. Testing before and after the intervention was performed with the SonoSim Livescan training platform using megacode scenarios. Two evaluators scored the accuracy of image acquisition, image interpretation, and time to scan completion. Before and after surveys assessed resident comfort level with performing ultrasound on a patient in shock, and basing decisions on findings. Statistical analysis was performed using McNemar's test for image acquisition and interpretation, paired T test for time, and Bahpkar test for the questionnaire.

Workflow

Standardized POCUS Introductory Training
↓
Pre-Megacode Questionnaire
↓
1 hour Cardiac and IVC lecture → 1 hour DVT and Pulmonary lecture → 3 hours Hands-on Practice → 1 hour RUSH lecture → 2 hours Hands-on Practice
↓
Post-Megacode Questionnaire

SONOSIM LIVESCAN

RESULTS

Sixteen EM residents were enrolled (11 junior and 5 senior). Improvement was achieved in IVC image acquisition and interpretation, interpretation for B-lines, lung sliding, cardiac apical and parasternal long axis, and DVT (p<0.05). Comfort level of performing ultrasound and basing decisions on the findings was increased (p<0.0001). Image acquisition speed increased among junior residents p <0.02. This was not observed in the senior cohort.

PUMP

Ultrasound Region	Pre-RUSH Success Rate	Post-Rush Success Rate	P-value
Apical Interpret	8/16 – 6/16	13/16 – 12/16	0.0253 – 0.0339
Apical Adequate	11/16 – 8/16	12/16 – 14/16	0.6547 – 0.0143
Subcostal Interpret	14/16 – 13/16	14/16 – 11/16	1.0000 – 0.3173
Subcostal Adequate	13/16 – 7/16	12/16 – 12/16	0.6547 – 0.0956
Parasternal Interpret	12/16 – 11/15	16/16 – 15/15	0.0455
Parasternal Adequate	13/16 – 12/16	16/16 – 16/16	0.0833 – 0.0455

TANK

Ultrasound Region	Pre-RUSH Success Rate	Post-Rush Success Rate	P-value
IVC interpret	2/15 – 1/15	11/15 – 10/15	0.0126 – 0.0067
IVC Adequate	0/15 – 0/16	10/15 – 11/16	0.0016 – 0.0009
RUQ Interpret	14/16 – 14/16	14/16 – 14/16	1.0000
RUQ Adequate	15/16 – 14/16	16/16 – 15/16	0.3173
Suprapubic Interpret	12/16 – 11/15	14/16 – 13/15	0.3173
Suprapubic Adequate	16/16 – 13/16	14/16 – 15/16	0.3173
LUQ Interpret	1/16 – 1/14	6/16 – 5/14	0.0588 – 0.1025
LUQ Adequate	15/16 – 11/16	16/16 – 16/16	0.3173 – 0.0253
B-lines Interpret	2/16 – 2/16	8/16 – 10/16	0.0143 – 0.0047
Left Chest Interpret	6/16 – 8/16	5/16 – 5/16	0.7055 – 0.3173
Left Chest Adequate	16/16 – 15/15	14/16 – 14/15	0.1573 – 0.3173
Lung Sliding Interpret	12/16 – 12/16	16/16 – 16/16	0.0455

PIPES

Ultrasound Region	Pre-RUSH Success Rate	Post-Rush Success Rate	P-value
Mid Aorta Interpret	15/16 – 15/16	16/16 – 16/16	0.3173
Mid Aorta Adequate	16/16 – 14/16	16/16 – 16/16	1.0000 – 0.1574
Right Groin Interpret	11/16 – 12/16	16/16 – 16/16	0.0253 – 0.0455
Right Groin Adequate	15/16 – 15/16	16/16 – 16/16	0.6547 – 0.0956
Left Groin Interpret	14/15 – 15/16	14/15 – 16/16	0.3173
Left Groin Adequate	14/15 – 14/16	15/15 – 16/16	0.3173 – 0.1573

CONCLUSIONS

We observed improvement in IVC image acquisition and interpretation, B-lines, lung sliding, cardiac apical and parasternal long axis interpretation, and DVT assessment. Subjective comfort level with performing and interpreting ultrasound in shock improved. Speed was improved in the junior resident group.

Categories without improvement generally had good baseline performance, likely reflecting the baseline training of the group, including speed in the senior group.

Limitations included a small sample size, lack of standardization in the evaluation tool and questionnaire, and a potential learning curve using the simulator. Further, although all residents were brought up to the same baseline core POCUS training, senior residents have experience and competence that probably affected the ability to detect measurable improvement. Evaluator bias was minimized by having two evaluators.

In summary, a RUSH Exam educational module improved image acquisition, image interpretation, speed, and comfort level among EM residents using ultrasound in critically ill patients.