INTRODUCTION

- Nurse anesthetists use central venous catheters to provide intravenous access for administering medications and for specialized monitoring of certain high-risk anesthesia patients
- The internal jugular (IJ) vein in the neck is one of the most common sites for central venous catheter insertion
- Neck anatomy is complex and multiple vital structures are near the insertion site
- With traditional landmark techniques, the complication rate for student practitioners placing central lines is a high as 7.8%
- Ultrasound-guided technique allows for continuous visualization of needle placement, which can reduce complications to as low as 1.9%

PURPOSE

- Simulation training is beneficial for learning ultrasound-guided central line insertion, but commercial simulation models are often cost-prohibitive
- Because of lack of access to affordable training models, students often have limited high fidelity simulated training experiences prior to practicing on a live patient
- The combination of 3D printed molds and silicone elastomer can be used to create anatomically accurate medical models that are easily reproducible with a low cost of production
- The purpose of this project was to demonstrate that a self-developed 3D print and silicone training model can provide an equivalent experience to a commercial model for ultrasound-guided central line insertion training

METHODS

- After IRB approval, 19 student participants were recruited from the Union University Nurse Anesthesia class of 2021
- Two pre-draped central line insertion stations were set up, one with the self-developed model, another with a BluePhantom Internal Jugular manikin
- In addition to the pre-draped model, each station contained a central line insertion kit and a GE Logiq ultrasound machine
- Students performed blinded ultrasound-guided central line insertions on each model
- Students were then asked to fill out an anonymous evaluation rating both models on realism of palpation and appearance, ultrasound picture, feel during needle insertion, overall realism, and usefulness as a training tool.
- Student ratings of each model were compared using paired t-tests

RESULTS

- Both models scored highly on student evaluations
- The self developed model achieved higher mean scores than the BluePhantom model on all evaluation items
- A statistically significant difference to a p-value <0.05 was found for realism of palpation and appearance and overall realism

DISCUSSION

- The total material cost for the self-developed neck model was less than $200, compared with a retail cost of $1,599 for the Blue Phantom Internal Jugular manikin
- 3D print designs can be posted as open-source plans and reproduced anywhere with a 3D printer

Limitations:

- The model was evaluated by student practitioners with varying levels of experience, rather than experienced anesthesia providers

Conclusions:

- The self-developed model was non-inferior to the BluePhantom training manikin in this evaluation
- 3D print and silicone elastomer ultrasound phantoms represent a feasible low-cost alternative to commercial ultrasound phantoms for anesthesia skills training

REFERENCES