

Deployed clinician self-study and self-debriefing in austere environments: An integrated tutor for a mixed reality simulator of thoracic regional anesthesia

The U.S. Army Medical Research Acquisition Activity, 820 Chandler Street, Fort Detrick, MD 21702-5014 is the awarding and administering acquisition office. This work was supported by the Department of the Office of the Assistant Secretary of Defense for Health Affairs under Award No. W81XWH-14-1-0113 and by the NIH/NCATS Clinical and Translational Science Award to the University of Florida UL1 TR000064 and the American Society of Regional Anesthesia. Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Department of Defense.

Zimmerman, Lizdas, Avari, Ihnatsenka, Lampotang

Word count 498; 500 max allowed, due 3/17

Background

Discovery learning is not as effective as organized curricula when trying to master complicated procedures like Thoracic Paravertebral (TPVB) and Thoracic Epidural (TE) placement. Medics and reservists deployed to distant theaters like Afghanistan work and train in environments that may be more austere than Stateside. Medical reservists often work in civilian practices and may be unfamiliar with military medicine (like subclavian central venous access instead of the internal jugular approach predominant in civilian medicine); once deployed, civilian reservists can train on simulators to acquire and maintain proficiency in unfamiliar medical procedures. To facilitate this goal, we designed and built a compact, modular simulator for use in austere environments (no simulation labs, classrooms, debriefing facilities/equipment, Internet access or instructors). To address lack of instructors exacerbated by time zone differences, we embedded an integrated tutor (IT) into a modular set of simulators to facilitate self-study and self-debriefing. Our IT is not an “intelligent tutor”; its content originates from human subject matter experts (SME), not machine intelligence. With the IT, deployed clinicians explore the curriculum in a self-paced learning environment that allows competency-based learning and assessment. An automated scoring algorithm scores performance. A self-debriefing feature itemizes where points were lost and why. The IT uses multimedia to provide instruction and feedback, allowing learners to master complex techniques at their own pace, while minimizing or eliminating instructor time.

Methods

Using an IT editor, a non-technical person assembled the IT with SME input. The IT is embedded into the simulator and covers four thoracic RA techniques: ultrasound-assisted or -guided TPVB, ultrasound-assisted or landmark-based epidural. The IT deconstructs complicated procedures into basic components and helps learners fine-tune their technique, step-by-step. We create individual IT steps from recording a SME using the simulator with external video camera footage, screen captures, and session replay files from the simulator. In many cases, the specific clinical actions were created first, then replayed in the simulator, allowing the SME to pause and articulate individual learning points using simulation options and cognitive aids as needed. The video camera recording the instructors' voice served as a base script to create formal versions of all recorded assets using iMovie. Thus, we minimized the SME's content creation time.

IT steps can optionally activate simulator settings such as cognitive aids, anatomical and visualization settings, and small competency-enhancing skill tasks that provide guided free-form learning. Short (~5 s) videos summarize longer videos. When deactivated, the IT leaves the main simulation unaltered.

Results

We have evaluated the IT with 15 trainees to date. Ultrasound (US) imaging was a harder skill to acquire but its mastery helped complete complicated tasks successfully. Even advanced practitioners take at least 1–2 hours of simulator practice on the simulator to efficiently manipulate the needle and use US to improve RA success and safety.

Conclusions

We expect that using the complete curriculum: self-study, mixed-reality simulation with 3D visualization, self-debriefing and IT will improve accuracy and precision of needle placement and US imaging and performance scores on the post-training practical exam.