


CAEP Feature Education Innovation Case Report

Name of Innovation	Using Hand Motion Analysis to Establish Learning Curves in Ultrasound Guided Central Venous Access
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Description of the Innovation	<p>Project Team Members: Bob McGraw, Tim Chaplin, Conor McKaigney, Louise Rang, Melanie Jaeger, Damian Redfean, Colleen Davison, Tamas Ungi, Matthew Holden, Caitlin Yeo, Zsuzsanna Keri, Gabor Fichtinger, Mark Woodcroft, Nici Rocca</p>  <p>Goals: The goals of this project were to develop a competency-based curriculum to teach junior residents the skills of ultrasound guided (USG) central venous catheter (CVC) insertion on a simulator, and to study the volume and type of practice that leads to proficiency in these skills.</p> <p>Preparation: Central venous catheter (CVC) insertion is a key procedural competency for residents in Emergency Medicine under the Medical Expert Role</p>

	<p>in the CanMEDS Physician Competency Framework. However, there is little evidence to inform the type and volume of practice that leads to proficiency in this skill.</p> <p>Methods: We used an iterative process for curriculum design starting with input from local experts. The curriculum was developed and implemented over the summers of 2014 and 2015. Based on instructor input, the curriculum was modified during training to increase the volume of practice and to include specific drills for the more challenging parts of the procedure. In particular, we found that residents require considerable practice of the skills of simultaneous probe manipulation, needle manipulation and image interpretation. In the current iteration of the curriculum residents learn both the femoral and internal jugular approach to USG CVC insertion, and practice the ultrasound dependent portion of the procedure approximately 85 times over the course of 3 training sessions. Hand motion analysis, which captures discreet movements of the hand and has been shown to be a valid measure of expertise in these skills, was performed at baseline and before and after each training session. Eight PGY2 residents, 4 from Emergency Medicine and 4 from Anesthesiology participated in the curriculum during the summer of 2015.</p> <p>Results: Over the course of training all 8 of the residents showed steady improvement, approaching or exceeding the expert benchmarks for ‘time for procedure’, ‘needle-hand motion count’ and ‘probe-hand motion count’ by the third training session and after practicing the US dependent portion of the procedure approximately 85 times. The time commitment and volume of practice is considerable, but is consistent with similar studies in the clinical setting.</p> <p>Reflective critique: A compelling argument can be made that there is an ethical imperative for residents to practice procedural skills as much as possible in the simulation lab prior to attempts on real patients. In learning USG percutaneous procedures residents tend to display a predictable pattern of errors including poor needle tip visualization, awkward probe manipulation and awkward needle manipulation. Overcoming these specific errors of technique requires considerable focused and deliberate practice along with expert feedback. This approach to learning is difficult, if not impossible in the clinical setting where opportunities for practice are inconsistent and residents are unable to pause mid procedure to practice specific elements. Therefore, in keeping with contemporary learning theory the novice resident will benefit from high volume deliberate practice of this procedure in the simulation lab, and the patient will benefit from avoiding the predictable pattern of errors made by novices.</p>
<p>Who wrote this summary?</p>	<p>Bob McGraw and Tim Chaplin</p>