



Training for ultrasound-guided central venous catheterization (CVC) is typically conducted on static manikin simulators with real-time feedback from a skilled observer. Dynamic haptic robotic trainers (DHRTs) are an alternative method that simulates various patient anatomies and provides consistent feedback for each insertion” Chen et al (2018).

Abstract;

**BACKGROUND:** Training for ultrasound-guided central venous catheterization (CVC) is typically conducted on static manikin simulators with real-time feedback from a skilled observer. Dynamic haptic robotic trainers (DHRTs) are an alternative method that simulates various patient anatomies and provides consistent feedback for each insertion. This study evaluates CVC needle insertion efficiency and skill gains of both methods.

**MATERIALS AND METHODS:** Fifty-two first-year surgical residents were trained by placing internal jugular (IJ) CVC needles in manikins ( $n = 26$ ) or robots ( $n = 26$ ). Manikin-trained participants received verbal feedback from an experienced observer, whereas robotically trained participants received quantitative feedback from the personalized DHRT learning interface. All participants were pretested on a Blue Phantom manikin; participants completed posttesting on a Blue Phantom manikin ( $n = 26$ ) or a novel manikin ( $n = 26$ ) with different vessel depth and position. During pretests and posttests residents were timed, motion-

tracked, and scored on an IJ CVC checklist.

**RESULTS:** (1) All skills on the IJ CVC checklist showed significant ( $P < 0.014$ ) improvements from pretests to posttest; (2) Average angle of insertion, path length, and jerk improved significantly ( $P < 0.005$ ); (3) Average procedural completion time, with standard error (SE) reported, decreased significantly from pretest ( $M = 3.516$  min,  $SE = 0.277$ ) to posttest ( $M = 1.997$ ,  $SE = 0.409$ ). **CONCLUSIONS:** No significant group differences were observed in overall skill gains, but residents' average procedural completion time decreased significantly from pretests to posttest. Overall results support DHRT as an effective method for training IJ CVC skills.

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### Reference:

Chen, H.E., Yovanoff, M.A., Pepley, D.F., Prabhu, R.S., Sonntag, C.C., Han, D.C., Moore, J.Z. and Miller, S.R. (2018) Evaluating Surgical Resident Needle Insertion Skill Gains in Central Venous Catheterization Training. *The Journal of Surgical Research*. 233, p.351-359.

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