Utilization of a Voice-Based Virtual Reality Advanced Cardiac Life Support Refresher Course: An Exploratory Analysis

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Background: Proper Advanced Cardiac Life Support (ACLS) training is vital due to the increasing incidence of cardiac arrests and variable in-hospital cardiac arrest survival rates in the United States. Despite requirements for healthcare professionals to have ACLS training, cardiac resuscitation survival rates are low, and clinicians demonstrate decay of skills over time. The current gold standard for ACLS training involves face-to-face, high fidelity exercises that simulate resuscitation codes. Limitations of this modality include long session duration, expensive durable equipment, and need for trained personnel. Virtual reality (VR) has been proposed as an alternative or adjunct to high fidelity simulation (HFS) in several environments, including engineering, sports, and aviation. Although fully immersive VR programs have been studied in the realm of ACLS education, no evaluations to date explored their ability to examine both technical and behavioral skills as well as demonstrate a cost comparison. Therefore, our objective was to evaluate the feasibility, human factor impact, and cost of a voice-based VR ACLS refresher course as compared to high fidelity simulation.

Methods: This prospective observational study performed at an academic institution consisted of 25 Post Graduate Year-2 (PGY-2) residents. Participants were randomized to high fidelity simulation or virtual reality training, and then crossed groups after a two-week washout. Participants were graded on technical and non-technical skills. Proctors were assessed for fatigue and task saturation using the NASA Task Load Index. Cost analysis was performed using local economic data.

Results: 23 of 25 participants were included in the scoring analysis. Fewer participants were familiar with VR compared to high fidelity simulation (36% vs 100% $p<0.001$). Although neither modality was overtly preferred, significantly more participants felt high fidelity simulation provided better feedback (99 [89-100] vs 79 [71-88], $p<0.001$). Scores were higher in the high-fidelity simulation group; however, non-technical scores for decision making and communication were not significantly different between modalities. VR sessions were shorter in duration than high fidelity simulation. NASA task load index scores for proctors were lower in each category for the VR group. VR sessions were estimated to be $103.68 less expensive in a single learner single session model.

Conclusion: Utilization of a VR based refresher for ACLS skills is comparable to high fidelity simulation in several areas. The VR module was more cost effective and was easier to proctor; however, high fidelity simulation was better at delivering feedback to participants. Further studies are needed to examine the utility of VR based environments at scale.

References:

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2. Wang P, Wu P, Wang J, Chi H-L, Wang X. A Critical Review of the Use of Virtual Reality in Construction Engineering Education and Training. *Int J Environ Res Public Health*. 2018;15(6).

Differences Between High Fidelity Simulation (HFS) and Virtual Reality (VR) in User Experience, Performance, and Cost

Variable	HFS N=23	VR N=23	P-Value
How real was the experience?	62.0 [50.5-70.0]	50.0 [44.5-66.0]	0.134
How useful was the experience in teaching you how to run a code?	90.0 [83-99.5]	83.0 [80.0-90.5]	0.080
How useful was the feedback received?	99.0 [89.0-100.0]	79.0 [71.-88.0]	<0.001
I enjoyed the experience n (%) Yes	23 (92.0)	22 (88.0)	0.637
I would like to use this as a way to recertify my ACLS n (%) Yes	25 (100)	23 (92.0)	0.149
Total Correct % Technical Domains	72.7 [60.0-78.2]	47.0 [40.0-58.0]	<0.001
Time per Session (minutes)	42 [38-44]	20 [18-21]	
Cost for Single Learner, Single Session*	$193.00	$89.32	

*Cost estimates based on purchase orders for equipment and salaries for New York Metro Area