Evaluating the Utility of Virtual Reality Programs for Surgical Resident Training in Minimally Invasive Surgery: A Systematic Review

Noor Habboosh MD[1], Rajika Jindani MD[1], Priyanka Parmar MD[1], Erin Moran-Atkin MD[1], Jenny Choi MD[1], Diego Camacho MD[1]

[1]Montefiore Medical Center/Albert Einstein College of Medicine

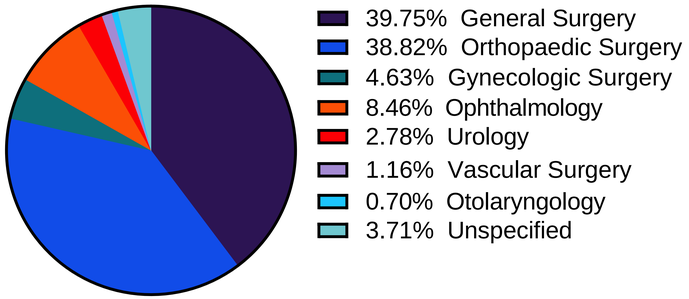
Objective

The near ubiquitous use of minimally invasive surgical modalities has catalyzed incorporation of these methods into the surgical resident training curriculum. Some institutions have opted to introduce virtual reality (VR) and simulator programs into their training milieu in order to provide trainees with a safe practice environment. Given the lack of both a standardized VR training curriculum and related assessment, it is difficult to evaluate the potential efficacy for resident skill acquisition and education. This study aims to examine the literature analyzing VR interventions' impact on resident education.

Methods

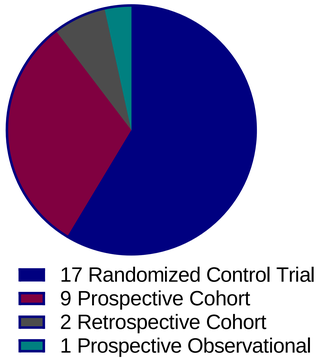
We performed a comprehensive search according to PRISMA (Preferred Reporting Items For Systematic Reviews and Meta-Analyses) guidelines, utilizing the PubMed and EMBASE electronic databases spanning English-language articles from 1993 to September 2023, using broad MeSH terms in PubMed. Studies examining the effect of VR/simulation interventions on surgery residents' education, encompassing minimally-invasive surgical or endoscopic procedures, were included. Primary outcomes included objective or expert assessments of number of attempts and time to successful completion of operative tasks, economy of motion, mental distress, and performance quality. Two independent reviewers evaluated studies using Moore's Expanded Outcomes Framework, and a third reviewer resolved rating discrepancies.

Represented Resident Specialties

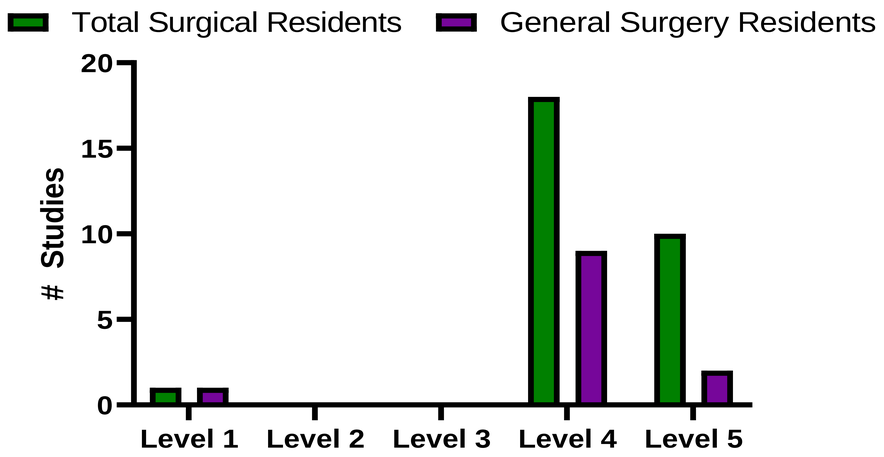


Total= 863 Residents across 29 studies

Type of Studies Represented



Distribution of Ratings Assigned to Publications



Results

Our search yielded 619 publications, 29 of which met inclusion criteria: 17 randomized control trials, 9 prospective cohort studies, 2 retrospective cohort studies, 1 prospective observational study. A total of 863 residents were included, 343 general surgery, 335 orthopedic surgery, 40 gynecologic surgery, 73 ophthalmology, 24 urology, 10 vascular surgery, 6 otolaryngology, and 32 unspecified. 10/29 (34%) studies achieved a Level 5 rating, which in this context indicates improved performance in the operating room, 18/29 (62%) were rated as Level 4, indicating competence in the educational environment (i.e. simulation lab). 1/29 (3%) was rated as Level 1, indicating only participation. Among studies only evaluating general surgery residents, 2/12 (17%) achieved a Level 5 rating, 9/12 (75%) achieved a Level 4 rating, and 1/12 (8%) a Level 1 rating.

Conclusions

Surgical trainees are expected to safely master minimally invasive techniques within a limited training period; there has been a notable uptrend in virtual reality/simulation programs to augment surgical education across subspecialties. This systematic review of studies examining the impact of these interventions on surgical resident education demonstrates that virtual reality/simulation programs can significantly improve residents' performance both in this controlled educational environment as well as the operating room.

Contact: Noor Habboosh, MD; Montefiore Medical Center/Albert Einstein College of Medicine; nhabboosh@gmail.com