

A SYSTEMATIC REVIEW ON THE EFFECT OF PLAYING VIDEO GAMES ON THE PERFORMANCE OF LAPAROSCOPIC SKILLS USING SURGICAL SIMULATORS

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Summary

- A systematic review to assess the effect playing video games has upon laparoscopic performance on surgical simulators.
- Playing video games significantly improved laparoscopic simulator performance in 8 out of the 9 included studies, including both basic laparoscopic skills and simulated laparoscopic procedures.
- Until a large, randomised study demonstrates that playing video games can be equally as effective and predictable compared to more traditional means of laparoscopic surgical simulation, it is not possible to advocate the implementation of a formal gaming curricula to a laparoscopic surgery training program at this current time.

Background

- Expertise in laparoscopic surgery is very difficult to achieve, and only occurs having gained a wealth of experience^[1]. The steep learning curve associated with attaining laparoscopic proficiency is largely due to the unique skills that must be mastered, such as overcoming the fulcrum effect, lack of tactile feedback, and the ability to perceive 3D images on 2D monitors^[2].
- There has been numerous studies that have attempted to ascertain if playing video games has an impact upon performance of laparoscopic skills. Gaming has been previously shown to cause increased aptitude for performance in hand-eye coordination and neuropsychological tests^[3, 4], improved reaction times, visuospatial perception, information processing, and mental rotation^[5, 6].
- While most evidence on this topic supports the theory that gaming can improve laparoscopic skill, previous systematic reviews have not been unanimous. The quality of the studies included in these reviews is also questionable, as most studies were observational, with very few Randomised controlled trials included (RCTs).

Aims

The aim of this study was to review relevant literature that examines the effect of gaming on laparoscopic performance using surgical simulators, with the objective of updating existing knowledge and determining if gaming can become a viable tool for formal laparoscopic training.

Methodology

- A systematic search was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines (PRISMA), in June 2020.
- The search was carried out on PubMed, Embase, Scopus, Ovid and Cochrane Central Register of Controlled Trials electronic medical databases.
- The search was completed using synonymous terms for video games and laparoscopy.
- All RCTs looking at the effect of playing video games as an intervention on task performance of laparoscopic skills using surgical simulators as the primary outcome were included.
- Reviews, case reports, letters, cohort studies and bulletins were excluded.
- Study and participant characteristic data was extracted, along with the laparoscopic performance outcome measures, which varied for each study included.
- The Medical Education Research Study Quality Instrument (MERSQI) was used to assess the the quality of each included article.

Results

- 1795 articles were found: 298 were identified as duplicates; 1459 articles were not relevant the research question, leaving 38 full text articles to be assessed. 29 were excluded due to meeting the exclusion criteria, leaving 9 articles to be included in this review.

- The MERSQI scores for each study are shown in **Figure 1**. The maximum score obtained was 15.5, which was achieved by four articles, while the lowest score obtained was 12.5, obtained by two articles. The average score of the nine articles was 14.5

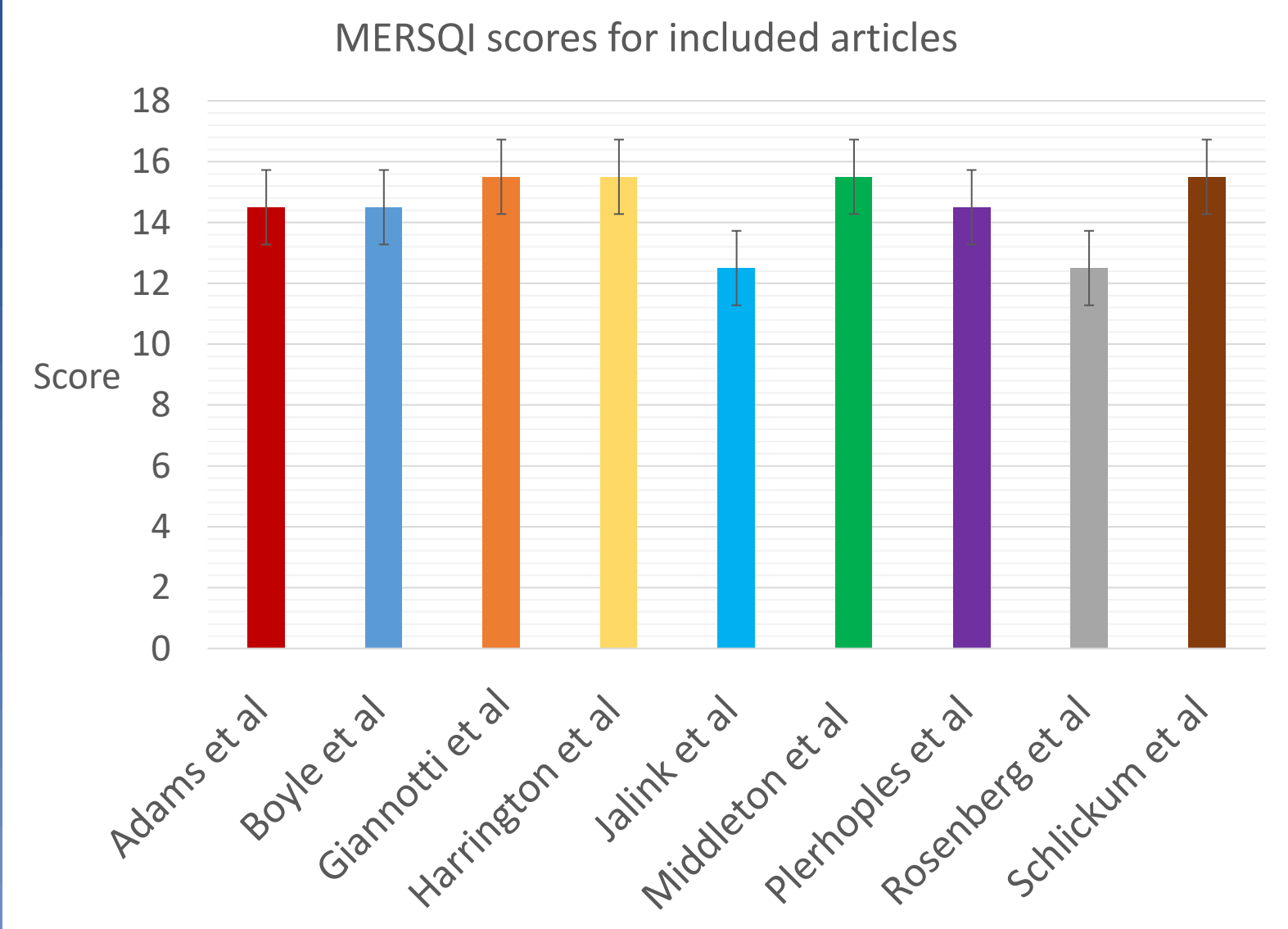


Figure 1. A bar graph of MERSQI scores for each included article.

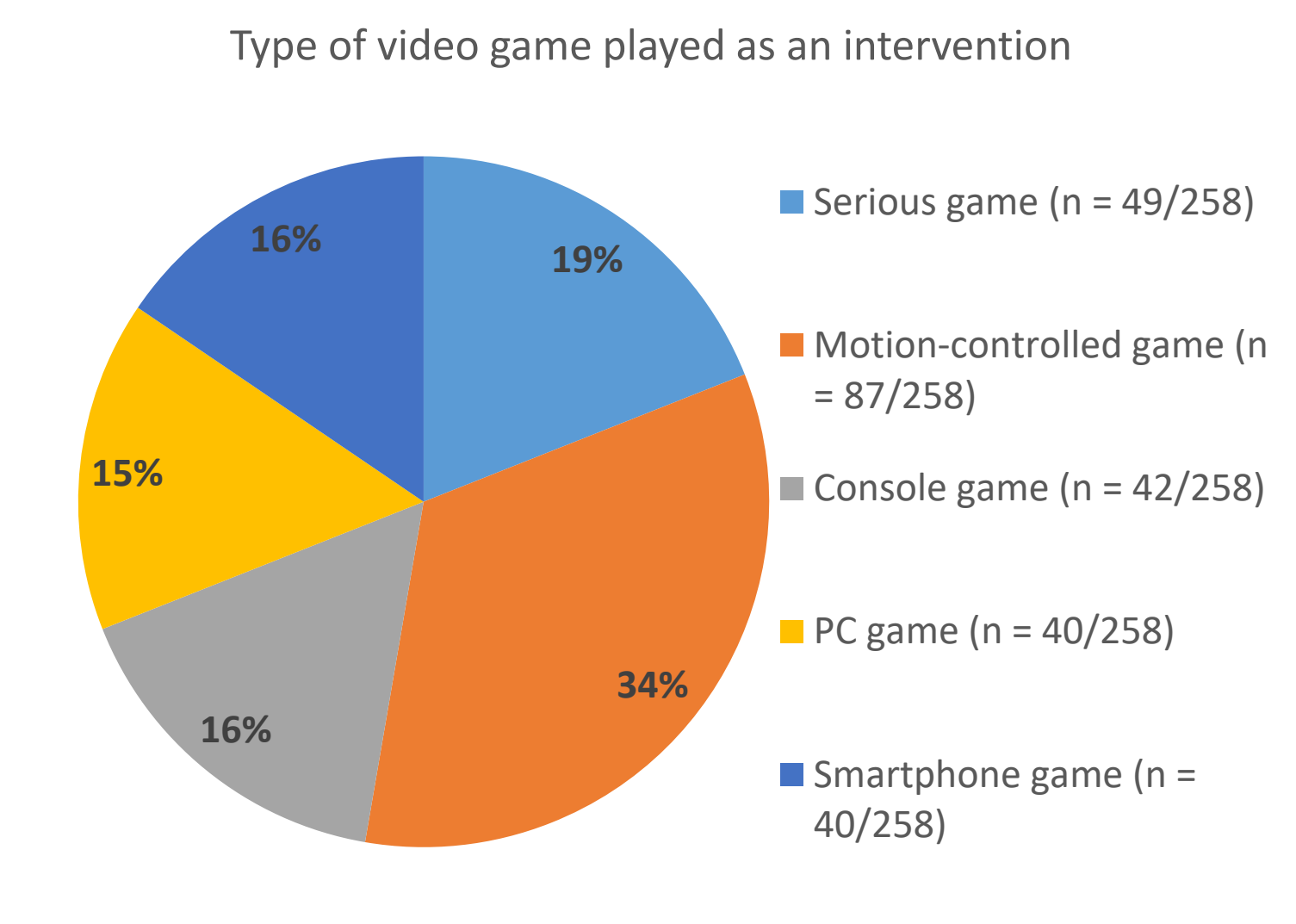


Figure 2. A pie chart of the type of video game played as an intervention in the included studies

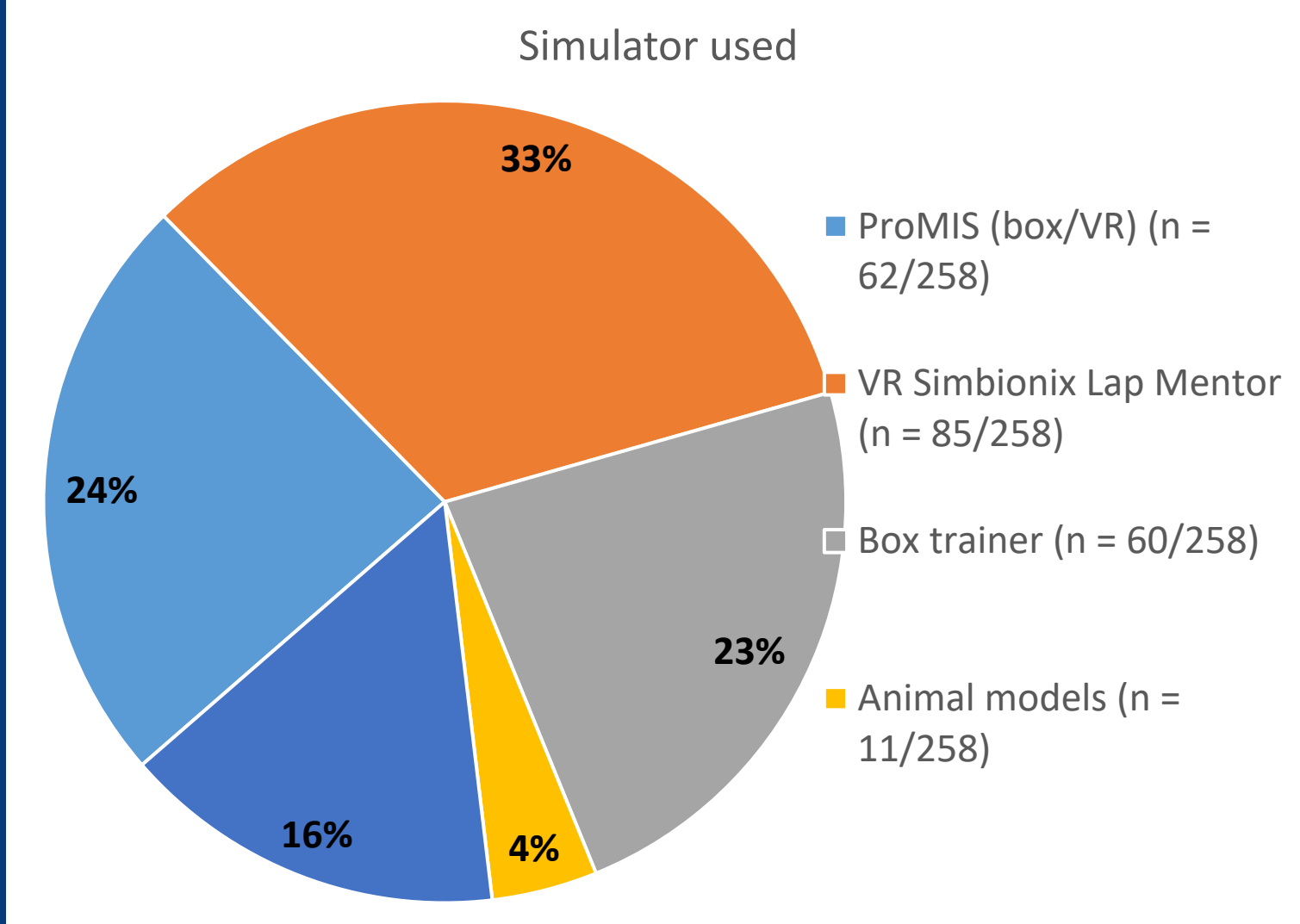


Figure 3. A pie chart of the type of simulator used to assess laparoscopic performance in the included studies

- A total of 258 participants were included in the nine studies, with there being a mix of surgical novices (medical students/surgical residents) or laparoscopic experts.

- The form of gaming utilised as an intervention varied between studies (**Figure 2**). The most common forms of games played across the studies were motion-controlled games or serious games.

- The type of simulator used to assess proficiency of laparoscopic skills also varied among studies (**Figure 3**). Most studies used a form of virtual reality laparoscopic simulator, but simple box trainers were also used, while one study used animal models for laparoscopic simulation.

- **Table 1** summarises the key findings of the 9 included studies. 8 out of the 9 studies found that playing video games resulted in a significant improvement in basic laparoscopic skills.

- Only one study did not find a significant difference from playing video games. Both studies that had their participants perform simulated laparoscopic full procedures found that playing video games significantly improved their performance also.

- However, the metrics found to be significantly improved were not uniform across the eight studies, with only one study to demonstrating that gaming as an intervention has a widespread effect upon laparoscopic performance. Statistically significant improvements in other studies were found in error rate or time to completion.

- Additionally, the overall reliability of this evidence is somewhat questionable due to some studies having very small sample sizes and the lack of standardised assessment methods across the studies.

Table 1. Summary of the main findings from each study.

Article	No significant difference	Statistically significant improvement in performance
Basic Laparoscopic tasks		
Adams et al. (2012)		✓
Boyle et al. (2011 ¹)		✓
Giannotti et al. (2013)		✓
Harrington et al. (2018)		✓
Jalink et al. (2014)		✓
Middleton et al. (2013)		✓
Plerhoples et al. (2011)		✓
Rosenberg et al. (2005)	✓	
Schlickum et al. (2009)		✓
Simulated laparoscopic full procedure tasks		
Giannotti et al. (2013)		✓
Schlickum et al. (2009)		✓

Conclusions

- The evidence from this review points towards the playing of video games improving laparoscopic surgical performance on surgical simulators that could one day be used to aid surgical trainees reach proficiency.
- However, the overall reliability of this evidence is questionable and therefore it is not possible to advocate the implementation of a formal gaming curricula to a laparoscopic surgery training program at this current time.

Limitations of this review

- Limitations of this systematic review include the search being carried out on electronic databases only and the relatively low sample sizes of some of the studies included.

Future work

- Future work should look to address standardizing a methodology that can be utilised across studies, in order to enable a more meaningful pooled statistical analysis of each studies results. This can include incorporating a standardized means of assessing laparoscopic performance (such as the FLS training program), as well as developing a standardized gaming program.
- If the results of these studies were to show a gaming program to be more or equally as effective as current laparoscopic surgical simulation training methods, this gaming program could one day become a tool used as part of laparoscopic training.

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