A Systematic Review on the Value of Robotic Surgery Simulation for Training Surgical Residents and Attendings

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INTRODUCTION

- Robotic surgery is becoming more prevalent in scope and usage for surgical cases.
- Simulation has been the go-to method of training robotic surgical skills.
- Compared with no intervention, simulation is associated with impressive benefits with respect to knowledge and skill acquisition. However, its impact on patient and hospital outcomes is unclear.

AIMS AND OBJECTIVES

- ***Research Question****:* To what extent are robotic simulations for training novice robotic general surgery residents and attendings associated with improved outcomes in comparison with no simulation training?
- ***Aim***: Summarize all available evidence on the effectiveness of robotic simulation training on patient and hospital outcomes (Levels 3 -5) using an evidence-based evaluation framework called the ROI Methodology

Level		Measurement Focus
1.	Reaction, Satisfaction and Planned Action	Measures participant's reaction to and satisfaction with a training program and participant's plans for action
2.	Learning	Measures increase in knowledge and/or skills, and changes in attitudes
3.	Application and Implementation	Measures transfer of knowledge, skills, and/or attitudes from classroom to the job (change in job behavior due to a training program)
4.	Impact	Measures business and/or healthcare (e.g., patient safety, quality of patient care, etc.) impact
5.	Return on Investment (ROI)	Compares the monetary value of the business and/or healthcare outcomes with the cost of the training program

Table 1: Level description in the Return on Investment methodology

METHODS

- ***Search*****:** Pubmed, Embase, Cochrane Library and Web of Science were searched with key words and terms. We excluded papers not in English or English translation available and non-full text papers. The papers were then uploaded into Covidence software with duplications removed.
- ***Screening***: Abstract and title screening was preformed by one individual. Level 1 and 2 outcome papers along with those not including general surgery residents were excluded. Full text screening was then completed by two screeners independently and in duplicate.
- ***Data Extraction:*** Data extraction and quality assessments were preformed with findings synthesized in narrative themes.

RESULTS

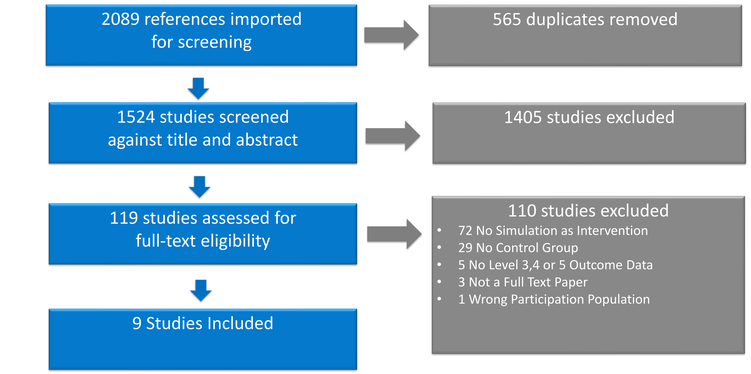
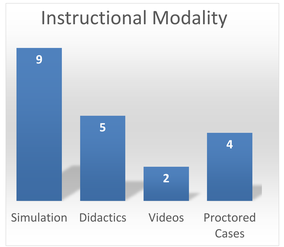
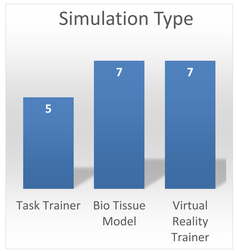


Figure 1: PRISMA schematic detailing the inclusion and exclusion of papers at different levels. 9 papers of the original 1524 papers met the inclusion metrics of full text paper, in English with Level 3,4 or 5 outcome data and a control group.





Figures 2 and 3:Instructional modality and simulation types present in the nine included papers. Multiple instructional and simulation types are present in many of the studies.

Table 2: Outcome levels using ROI Methodology for the nine included papers. Some papers have multiple outcome levels present

Outcome Levels in Included Papers	
Level 1	1
Level 2	0
Level 3	**4**
Level 4	**6**
Level 5	**0**

CONCLUSIONS

Level 3: 4/1524 (0.26%)

- There is no benefit of simulation to increase resident/fellow/attending usage of a robotic platform.

Level 4: 6/1524 (0.39%)

- Less blood loss and greater lymph node harvests were noted in pancreas cases done by the simulation group in two papers but the third found no difference.
- Decreased cost in inguinal hernia cases who have surgeons that have completed a simulation course.

Level 5: 0/1524 (0%)

DISCUSSION

- Despite the increase in the use of simulation for robotic surgery training, there is limited evidence demonstrating the benefits of simulation on patient and hospital related outcomes.
- What limited data exist point to a possible benefit in operating room time, cost and blood loss but shows no congruency between the studies.
- The three Level 3 studies available suggest that simulation does not increase usage of the robotic platform.
- To fill these gaps significant increases in research will need to be done at higher outcome levels.

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