

Does Simulation Training in Pediatrics Improve Patient Outcomes, Cost, and Latent Safety Threats? A Scoping Review

Samuel Graef^a, Nima Karimi^a, Maggie Xu^a, Jo-Anne Petropoulos^b, Quang Ngo^{c,d}, Elif Bilgic^{c,d*}

^aMcMaster University, Faculty of Health Sciences;

^bMcMaster University, Health Science Library;

^cMcMaster University, Department of Pediatrics;

^dMcMaster University, Education Research Innovation and Theory (MERIT) program

Background

Pediatrics is a specialty that has a significant procedural component whereby residents are expected to be competent in various pediatrics procedures. With simulation-based training (SBT), trainees can practice procedural abilities without any patient safety concerns. SBT can be explored in terms of its potential impact on patient outcomes, latent safety threats, and cost. Patient outcomes are otherwise known as T3 level outcomes, while cost and identification of latent safety threats are collectively known as T4 level outcomes.

Objectives

The purpose of this review is to identify and describe studies that have investigated the impact of pediatric procedural skills related to SBTs on patient outcomes, latent safety threats, or cost.

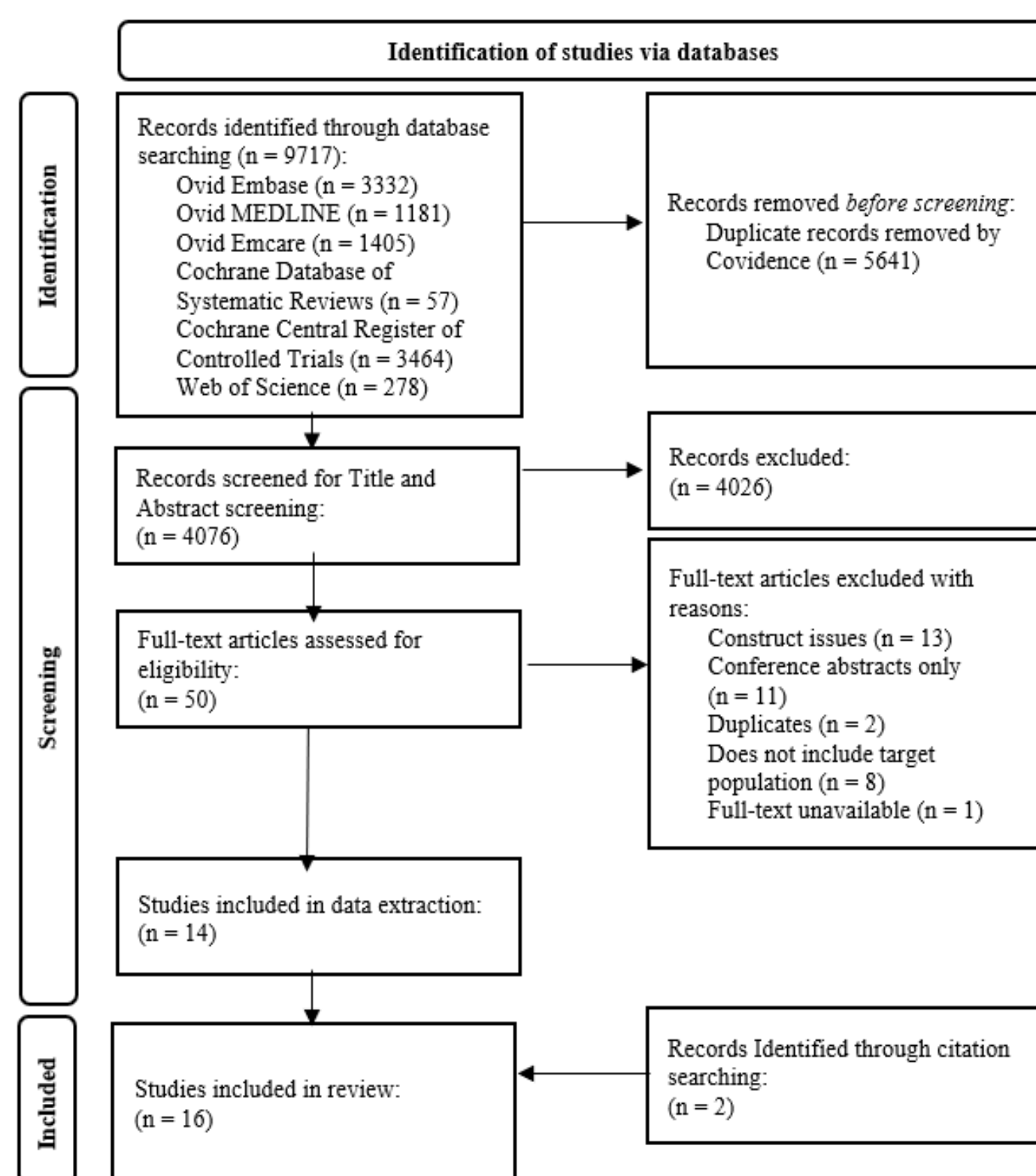
Methods

- Search strategies were developed with the assistance of a librarian and six databases were searched from January 2011 to September 2022.
- Three independent reviewers performed pilot screenings before title/abstract and full-text screenings, in order to ensure a rate of agreement of 75%.
- Following full-text screening, data extraction of eligible articles was conducted to gather information on interventions, outcomes, research design, and other study characteristics.

Inclusion Criteria

Full-text articles were included if they were:

- Empirical studies
- Focused on simulation training for pediatric procedural skills
- Included T3/T4 level outcomes
- Focused on medical students, residents, and/or fellows



Study Characteristics (N=16)

Country where study was conducted	
USA	6
Australia	2
India	2
Kenya	1
Mexico	1
Nepal	1
UK	1
Rwanda	1
Uganda	1
Year of publication	
2017-2022	8
2011-2016	8
Journal type	
Medical or surgical	12
Simulation	3
Multidisciplinary	1
Funding	
Funded	7
No funding received	4
NS	5
Study Design	
Quantitative	14
Mixed-methods	2
Study Group	
Single Group	11
RCT	4
NS	1

NS Not specified; USA United States of America; UK United Kingdom
 RCT Randomized Controlled Trial (trainees are randomly assigned to 2 or more groups - 1 group is usually the control group, whereby those participants do what they would normally do, and experimental groups go through their assigned educational interventions such as simulation training)
 Single group (all of the trainees complete the same intervention without any comparison)
 Quantitative (experimental, quasi-experimental)
 Mixed-methods (collection of qualitative and quantitative data)

Future Research Should:

- Focus on conducting higher quality research.
- Explore the impact of SBT on T4 level outcomes (e.g., potential decrease of hospital level costs associated with decrease of complication rates)
- Explore the types or combination of T3/T4 level outcomes that could be valuable to investigate the effectiveness of SBT.

Main Results

- The majority of articles were published under medical or surgical journals (n=12) and in the USA (n=6).
- In terms of study design, there were very few randomized controlled trials (RCTs) (n=4) and all of the studies collected quantitative data.
- Regarding the procedures, most studies focused on resuscitation skills including bag-and-mask ventilation (n=3).
- Most of the interventions included the use of mannequins as a form of simulation technology (n=8), and participants were mainly residents/fellows (n=8).
- 10 studies examined mortality as their outcome measure, one focused on LSTs, while no studies examined the cost of patient care.

Study Outcomes

Outcome Level (N=16)	
T3	15
T4	1
T3 Level Outcomes (N=31)	
Mortality/number of deaths	10
Survival rates/success rate/improvement	3
Time to intervention/failure	4
Patient safety events (PSEs)	1
Number/proportion of patients who require intervention	3
Rate of admissions/length of admissions stay	2
Incidence of illness/injury or number of cases	5
Pain, complications, and other symptoms	2
Near misses	1
T4 Level Outcomes (N=1)	
LSTs	1
Time Points Measured (N=16)	
Done once ^a	2
Repeated Measurements ^b	14

^aDone once (desired outcomes are measured once (e.g., after intervention only))
^bRepeated measurements (desired outcomes are measured repeatedly (e.g., before/after intervention))

Conclusion

The majority of studies focused on the evaluation of T3 level outcomes including mortality. Though some studies reported a significant decrease in mortality rates, the overall quality of the research designs were low.