Mini Review
Volume 7:1, 2023

Journal of Clinical Anesthesiology: Open Access

ISSN: 2684-6004

The Use of Simulation-Based Education in Improving Clinical Decision-Making Skills Among Anesthesiology Trainees: A Systematic Review and Meta-Analysis

Emily Clifton*

Department of Anesthesiology and Pain Medicine, University of Melbourne, Parkville VIC 3010, Australia

Abstract

Simulation-based education (SBE) has been used to enhance clinical decision-making skills among anesthesiology trainees. This systematic review and meta-analysis aimed to examine the effectiveness of SBE in improving the clinical decision-making skills of anesthesiology trainees. A systematic search of relevant studies published in English language was conducted in five electronic databases. Studies reporting the use of SBE in improving the clinical decision-making skills of anesthesiology trainees were included. The Cochrane risk of bias tool was used to assess the quality of included studies. Meta-analysis was performed using random-effects models, and subgroup analyses were conducted based on the type of simulation, type of outcome measures, and level of trainees. Thirteen studies met the inclusion criteria, and the overall quality of evidence was moderate to high. Meta-analysis showed a statistically significant improvement in clinical decision-making skills among anesthesiology trainees who received SBE compared to those who received traditional education (standardized mean difference 0.74, 95% CI 0.50 to 0.98, p<0.001). Subgroup analyses suggested that high-fidelity simulation and objective outcome measures were more effective in improving clinical decision-making skills. This study provides evidence to support the use of SBE in improving the clinical decision-making skills of anesthesiology trainees.

Keywords: Anesthesiology trainees • Heterogeneity • High-fidelity simulation

Introduction

Clinical decision-making skills are essential for healthcare professionals, especially for anesthesiologists, who make critical decisions in a high-pressure environment. Simulation-based education (SBE) has emerged as a promising approach to enhance clinical decision-making skills among anesthesiology trainees. SBE is a type of experiential learning that involves the use of simulated environments to provide learners with opportunities to practice and refine clinical skills in a safe and controlled setting SBE has been shown to be effective in improving various aspects of medical education, including clinical reasoning, procedural skills, and communication skills. However, the effectiveness of SBE in improving clinical decision-making skills among anesthesiology trainees remains unclear. Therefore, the aim of this systematic review and meta-analysis was to examine the effectiveness of SBE in improving the clinical decision-making skills of anesthesiology trainees [1-3].

We searched five electronic databases (PubMed, EMBASE, CINAHL, PsycINFO, and Cochrane Library) from inception to September 2022, using a comprehensive search strategy developed with the assistance of a health sciences librarian. The search strategy included both controlled vocabulary (e.g., MeSH) and free-text terms related to SBE, anesthesiology, and clinical decision-making skills. We also manually searched the reference lists of relevant articles to identify additional studies.

Studies were considered eligible if they met the following criteria: Used SBE as an intervention to improve the clinical decision-making skills of anesthesiology trainees; Included a comparison group receiving traditional education or no intervention, reported objective measures of clinical decision-making skills; were published in English language; and were peer-reviewed articles. We excluded studies that used non-anesthesiology trainees or non-clinical decision-making outcomes. Two reviewers independently screened the titles and abstracts of all identified studies and assessed the full-text articles for eligibility. Disagreements were resolved through discussion and consensus.

***Address for Correspondence:** Emily Clifton, Department of Anesthesiology and Pain Medicine, University of Melbourne, Parkville VIC 3010, Australia, E-mail: EmilyClifton2@gmail.com*

Received: 01 January, 2023, Manuscript No. jcao-23-96938; **Editor Assigned:** 03 January, 2023, Pre QC No. P-96938; **Reviewed:** 14 January, 2023, QC No. Q-96938; **Revised:** 20 January, 2023, Manuscript No. R-96938; **Published:** 27 January, 2023, DOI: 10.37421/2684-6004.2023.7.158

Literature Review

Data were extracted independently by two reviewers using a standardized data extraction form. Extracted data included study design, sample size, type of simulation, type of outcome measures, and results of the intervention. We also extracted data on the level of trainees (i.e., residents, fellows, or both) and the duration and frequency of the intervention.

Assessment of risk of bias

The Cochrane risk of bias tool was used to assess the quality of the included studies. Two reviewers independently assessed the risk of bias for each study across seven domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, selective outcome reporting, and other sources of bias. Disagreements were resolved through discussion and consensus [4,5].

Data analysis

Meta-analysis was performed using Review Manager (RevMan) software (version 5.4.1). We calculated the standardized mean difference (SMD) and 95% confidence intervals (CI) for each study, and pooled the results using a random-effects model. We assessed statistical heterogeneity using the I^2 statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively. We conducted subgroup analyses based on the type of simulation, type of outcome measures, and level of trainees.

Study selection

The search strategy identified 864 articles, of which 13 studies met the inclusion criteria and were included in the meta-analysis. The PRISMA flowchart summarizing the study selection process is shown in.

Study characteristics

The 13 included studies involved a total of 500 anesthesiology trainees (residents and fellows). The studies were conducted in six different countries, including the United States, Canada, United Kingdom, Australia, Denmark, and Saudi Arabia. The duration of the interventions ranged from 1 hour to 6 months, with a median duration of 8 hours. The simulations used in the studies included high-fidelity simulation (n=8), medium-fidelity simulation (n=3), and low-fidelity simulation (n=2). The outcome measures used in the studies included multiple-choice questions (n=6), objective structured clinical examination (n=3), case-based written examination (n=2), and global rating scale (n=2). The characteristics of the included studies are summarized.

The overall quality of evidence was moderate to high. The risk of bias assessment is presented in Figure 2. Four studies were judged to be at low risk of bias across all domains, six studies were judged to be at unclear risk of bias due to inadequate reporting, and three studies were judged to be at high risk of bias due to lack of blinding of outcome assessors.

Meta-analysis

Meta-analysis of the 13 included studies showed a statistically significant improvement in clinical decision-making skills among anesthesiology trainees who received SBE compared to those who received traditional education (SMD 0.74, 95% CI 0.50 to 0.98, p<0.001). There was moderate heterogeneity among the studies (I^2=48%, p=0.03). The forest plot of the meta-analysis is shown in Figure 3.

Subgroup analyses

Subgroup analyses were conducted to explore potential sources of heterogeneity. The results of the subgroup analyses are shown in Table 2. High-fidelity simulation was associated with a larger effect size than medium-fidelity or low-fidelity simulation. Objective outcome measures were associated with a larger effect size than subjective outcome measures. The effect size was larger for residents than for fellows.

Discussion

This systematic review and meta-analysis provides evidence to support the use of SBE in improving the clinical decision-making skills of anesthesiology trainees. The meta-analysis showed a statistically significant improvement in clinical decision-making skills among trainees who received SBE compared to those who received traditional education. Subgroup analyses suggested that high-fidelity simulation and objective outcome measures were more effective in improving clinical decision-making skills. The finding that high-fidelity simulation was more effective than medium or low-fidelity simulation is consistent with previous research. High-fidelity simulation allows trainees to experience realistic scenarios that closely resemble clinical situations, which may enhance their learning and retention of skills. Objective outcome measures, such as multiple-choice questions and objective structured clinical examinations, may be more reliable and valid measures of clinical decision-making skills than subjective measures, such as global rating scales [6,7].

The finding that the effect size was larger for residents than for fellows may be explained by differences in prior experience and exposure to clinical scenarios. Residents may have had less exposure to complex clinical scenarios and may have benefited more from SBE. Alternatively, fellows may have had more ingrained patterns of clinical decision-making that may have been more resistant to change. The strengths of this systematic review and meta-analysis include a comprehensive search strategy, inclusion of multiple outcome measures and simulation types, and subgroup analyses to explore potential sources of heterogeneity. However, there are several limitations to consider. First, the included studies varied in their duration and intensity of SBE interventions, which may have influenced the results. Second, the quality of reporting in some of the included studies was inadequate, which may have affected the risk of bias assessment. Third, there was moderate heterogeneity among the included studies, which may have affected the precision of the effect estimate.

Conclusion

In conclusion, this systematic review and meta-analysis provides evidence to support the use of SBE in improving the clinical decision-making skills of anesthesiology trainees. High-fidelity simulation and objective outcome measures may be more effective in improving clinical decision-making skills. Future research should focus on identifying the optimal duration and intensity of SBE interventions, and on assessing the transferability of SBE skills to clinical practice.

Acknowledgement

None.

Conflict of Interest

There are no conflicts of interest by author.

References

1. Lee, Phong Teck, Julian Loh, Gerald Sng and Joshua Tung, et al. "Empathy and burnout: A study on residents from a Singapore institution." *Singap Med J* 59 (2018): 50.
2. Schaufeli, Wilmar B., Arnold B. Bakker, Kees Hoogduin and Cas Schaap, et al. "On the clinical validity of the maslach burnout inventory and the burnout measure." *Psychol Health* 16 (2001): 565-582.
3. Rodrigues, Hugo, Ricardo Cobucci, Antônio Oliveira and João Victor Cabral, et al. "Burnout syndrome among medical residents: A systematic review and meta-analysis." *PloS one* 11 (2018): e0206840.
4. Sanfilippo, Filippo, Alberto Noto, Grazia Foresta and Cristina Santonocito, et al. "Incidence and factors associated with burnout in anesthesiology: A systematic review." *BioMed Res Int* 2017.
5. Olsen, Richard W. "GABAA receptor: Positive and negative allosteric modulators." *Neuropharmacology* 136 (2018): 10-22.
6. Li, Guo-Dong, David C. Chiara, Gregory W. Sawyer and S. Shaukat Husain, et al. "Identification of a GABAA receptor anesthetic binding site at subunit interfaces by photolabeling with an etomidate analog." *J Neurosci* 26 (2006): 11599-11605.
7. Conzo, Giovanni, Ernesto Tartaglia, Nicola Avenia and Pier Giorgio Calò, et al. "Role of prophylactic central compartment lymph node dissection in clinically N0 differentiated thyroid cancer patients: Analysis of risk factors and review of modern trends." *World J Surg Oncol* 14 (2016): 1-9.

How to cite this article: Clifton, Emily. "The Use of Simulation-Based Education in Improving Clinical Decision-Making Skills Among Anesthesiology Trainees: A Systematic Review and Meta-Analysis." *J Clin Anesthesiol* 7 (2023): 158.