Article Type: Review
J Name: Modern Phytomorphology
Short name: MP
ISSN: ISSN 2226-3063/eISSN 2227-9555
Year: 2024
Volume: 18
Page numbers: 165-174
DOI: 10.5281/zenodo.200121
(10.5281/zenodo.Year-Volume-PDFNo.)
Short Title: Assessment Quality of simulation-based training in the healthcare sector and role of phytomorphology: A systematic review

REVIEW ARTICLE

Assessment Quality of Simulation-Based Training in the Healthcare Sector and Role of Phytomorphology: A Systematic Review

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Received: 19.02.2024, Manuscript No. mp-24-148032 | Editor Assigned: 22.02.2024, Pre-QC No. mp-24-148032 (PQ) | Reviewed: 07.03.2024, QC No. mp-24-148032 (Q) | Revised: 02.09.2024, Manuscript No. mp-24-140576 (R) | Published: 30.09.2024

Abstract

Simulator-based training is a popular method of raising the standard of medical treatment. However, no comprehensive research has yet shown its effect on registered doctors and nurses. The purpose of this systematic analysis is to evaluate how simulation-based medical and nursing education affects doctors' and nurses' skills and knowledge. Searches across 10 computerized databases (CINAHL, EMBASE, MEDLINE, Scopus, Social Science Citation Index, Web of Science and Google Scholar) were used to perform a systematic review with research synthesis. Studies offering information on simulation as well as instruction in the healthcare industry that were published in journals between 2013 and 2023 were qualified for inclusion. Six research papers that passed the eligibility check conducted by the study's authors were included in the analysis. Simulator-based training's impact varies greatly across research. This meta-analysis showed that simulation-based instruction had a significant effect when compared to other learning modalities, despite the low quality of the data, which signalled uncertainty. Other comparisons produced contradictory results. Based on the findings, simulation training is an effective way to improve healthcare professionals' skills, but further high-quality research with adequate sample sizes is needed.

Keywords: Simulation, Training, Healthcare sector, Healthcare professionals

Introduction

Patients may get sophisticated, complicated treatments from healthcare providers. Therefore, to ensure patient safety, highly qualified and knowledgeable healthcare professionals are required (Grol et al., 2008). According to studies, mistakes in healthcare pose a danger to patient safety but are often preventable (Patel et al., 2015). As a result, concerns like patient safety and quality enhancement are crucial for today's society (Institute for Healthcare Improvement, 2015). Clinical audits or evidence-based recommendations are only two examples of strategies for quality improvement (Ivers et al., 2012; NICE, 2014). Simulation-based training is another tactic to improve student and healthcare professional performance. Both the World Nursing Association for Clinical Simulation or Learning (2013) and the Society for Simulation at Healthcare (2014) define simulation-based training as

the imitation of realistic situations using an adapted manikin, software on a computer, or real people acting as patients.

High-fidelity settings with sophisticated manikins and equipment are frequently referred to as technology-enhanced simulations. Where the technology is less sophisticated, it may also be low-fidelity (Healthy Simulation, 2014; Salas et al., 2013). The most advanced manikins available today replicate human physiology down to perspiration and tears and pulse and blood pressure levels. Using specialized computer software, the facilitator has the capacity to control the settings in response to the activities taken by the health personnel (Healthy Simulation, 2014).

Previous studies that thoroughly investigated the advantages of simulation-based training for students enrolled in healthcare professions programs discovered considerable impacts on the student's knowledge and abilities as well as small improvements in patient-related outcomes. Simulation-based training may improve adherence to recommendations for safe medication in critical care nurses' continuing education programs (Jansson et al., 2012). A variety of outcomes seem to be impacted by further technical advancements in emergency medicine simulation (Ilgen et al., 2013). A pleasant learning environment and links between theory and practice were also fostered *via* simulation, according to an ethnographic investigation of midwifery students (Lendahls & Oscarsson, 2017).

Only one cohort research was discovered in a single analysis that compiled the evidence for graduated doctors separately. Since nurses utilize this learning approach often, it is important to assess its effectiveness. This comprehensive analysis aims to explain how simulation-based teachings affect nurses' knowledge and abilities.

Materials and Methods

CINAHL, EMBASE, MEDLINE, Scopus, Social Science Citation Index, Web of Science, and Google Scholar were among the electronic databases that were searched. The keywords "training," "high fidelity," "healthcare," "medical sector," and "Healthcare professional" were used in searches related to simulation. Each of these phrases was coupled with a different search term that was focused on decision-making. These included "training" in "healthcare," "professional," and "Simulation." The reviewer then conducted an independent evaluation of a selected sample of articles using data extraction questionnaires along with quality assessment tools that had already been established. Every single point on the item's rating scale was discussed in public to reach a consensus.

Inclusion criteria

- The article reported the effect of simulation and training on the healthcare sector
- Full text articles
- Articles of any design written in English

Exclusion criteria

- Articles not reporting the effect of simulation and training on the healthcare sector
- Non peer-reviewed articles

Quality assessment

There were no linguistic limitations when exploring a range of printed or digital items. Several websites were also employed to go through potential references on the internet. There were established criteria for inclusion and disqualification in writing. Wide standards for critical review were used to conduct a more complete quality assessment of selected publications.

These comprehensive quality assessments were utilized to assess heterogeneity and decide if meta-analyses were required. A detailed process was developed to choose the optimal control group for this experiment. The criteria for evaluating the literature have taken P.I.C.O. into account. According to (Cronin et al., 2008), nurses must be prepared to study, understand and critically assess the research that has generated the findings to be able to adopt best practices. A systematic review, as described by (J, 2010), is a kind of

review of literature that gathers the research on a certain issue. The results should be supported by reliable data the fact that has been carefully and succinctly produced for those reading to challenge them. This is reinforced by (Cumpston et al., 2019), which asserts that a systematic review should address a particular research topic by locating, evaluating and synthesizing all material that is publicly available and satisfies a certain eligibility condition. 2009's Pippa Hemingway proposes that each piece of evidence, both unpublished and published, should be identified in a high-quality systematic review. Then, following the inclusion criteria, choose the review papers. The quality of these selected studies may then be assessed. After that, the findings should be presented objectively. Following this combination, the outcomes should be evaluated and a fair and impartial summary should be made while taking into account any flaws in the data at hand.

Data collection strategies

(Cochrane Training, Chapter 5: Collecting Data, n.d.) In systematic reviews, the phase of data collection is essential since it forms the basis for the necessary inferences. This means making sure the data is trustworthy, precise, comprehensive and accessible. Searches were conducted in the databases Science Direct, Embase, Scopus, PubMed, Web of Science (ISI) and Google Scholar as part of the first phase of this systematic review and meta-analysis. All conceivable combinations of the keywords "training," "health," "care," "healthcare," and "professionals" were utilized in the simulation search phrases to find the articles. Although there was no time limit on the search strategy, endnote was used to record the meta-analysis of the study that was discovered. The lists of all references utilized in each of the gathered articles were carefully examined to increase the search's thoroughness.

Keywords used as per MeSH: Simulation included ‘simulator’, ‘healthcare’, ‘skills’, ‘healthcare’ and ‘health science’.

Inclusion/exclusion criteria

To determine the pertinent inclusion and exclusion requirements for this review, a clear method was developed (Tab 1). P.I.C.O. was taken into account while developing the inclusion and exclusion criteria for the literature analysis. As recommended by (Torgerson & Torgerson., 2003), By doing this, it was ensured that the research question was followed along with the appropriate research articles found. Because this evaluation focuses on deciding on the option of becoming a mother for pregnant women with HIV, which was judged suitable, the criteria for inclusion and exclusion within the literature review constitute a source of possible bias (Pati & Lorusso., 2017). The detailed records of such excluded and included criteria might thereby increase confidence and reliability. Researchers understand that it may not always be easy to ascertain why certain publications have been excluded from assessment, but they still need to justify their choices. He continues by saying that occasionally too broad or narrow of search criteria are used, which might lead to results that aren't necessarily relevant. The requirements established by PICo paper older than a decade was eliminated to condense the search results to a workable number. According to Lipscomb (n.d.), nurses must study the most recent research to improve patient care. This is because they are expected to adopt evidence-based practice. However, the study admits such time-scale cutoffs weren't advantageous since some older material might still be relevant or instructive. Since linguistic bias may exist owing to the writers' not enough language skills and the possibility of a poor translation, the research study removed pieces that hadn't been posted in English. Although (Pet et al., 2002) agree that evaluates presented in writing seem to have substantially a greater probability of being included in additional studies and be distributed more than once although this exclusion typically has little effect on the findings, their justification could be interpreted as being opposed to this tactic. Research investigation started by doing a basic Boolean operator search for essential terms and afterwards then added further filters depending on my inclusion needs. The research study was only able to find 28 research papers from CINAHL, 39 articles from Medline and 75 articles from PubMed after narrowing down my whole search. The

research study methodology used a PRISMA flow diagram (Fig 1) to choose my publications from among these 142. Many were ignored since they had no relevance to the topic of the research. Research study eliminated any duplicates and reviewed each publication's abstract. Overall, six papers were included because they met the requirements for this systematic review. Research work also skipped over papers that lacked a meta-analysis. Research study have included the 117 papers that we thought could be relevant but ultimately eliminated, along with each exclusion's justification. The most common reasons for removal were study design (not a thorough examination) and multi-component trials with insufficient data on the effects of simulation and education of the healthcare industry.

Table 1. **Inclusion and exclusion criteria**

Population/Problem	**Healthcare sector**
Interest	Simulation and training
Context	Asia
Inclusion criteria	**Exclusion criteria**
Healthcare sector	Other sectors
Articles written in English	Articles from more than a decade ago
Studies that examined the effect of Simulation and Training on the Healthcare sector.	Studies with little information
Original research	Duplicate sources
Studies whose whole text was accessible	Case reports

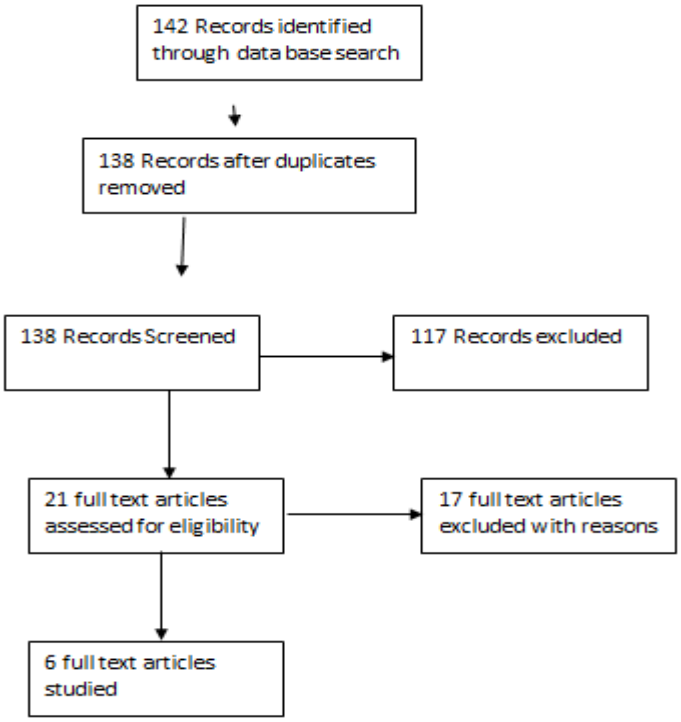

Figure 1. PRISMA flow diagram.

Results

The final pieces will undergo analysis and criticism. All six of the studies that were examined ranged in length from a single month to two years. The selection-at-random approach was utilized in investigations when the participant characteristics exhibited no discernible variation. The quality and understanding-improving potential of the literature might be evaluated *via* the application of an analytical framework (Oxford Centre for Triple Value Healthcare Ltd, n.d.). A summary of each article is included in the Tab 2.

Table 2. A summary of each article.

Sample/setting	Study purpose	Main findings
N=253 (Taiwan)	Identify the impact of gender affects communication abilities	253 medical students in all were recruited, 166 of them were men and 87 of them were women. Male examiners' checklist rating ratings were considerably lower than female examiners' scores when students interacted with male standardized patients (male examiners, P=0.006; female examiners, P=0.001). Male students' checklist rating ratings for standard patients were considerably lower than those for standard patients who were female (male examiners, P=0.006; female examiners, P=0.008). When evaluated by male examiners, male students' checklist rating ratings were considerably lower than those of female students for male standard patient populations (P=0.044). The overall rating ratings were similar, except when female students connected with both male and female SPs and were rated by female examiners (P=0.004)
Intervention group=48, control group=46 (South Korea)	Identify the knowledge, abilities, and self-confidence of students after participating in simulations	According to the data, the pupils in the lab group had superior clinical reasoning abilities and relevant knowledge compared to those in the regular didactic lecture group, but there was no difference in their levels of confidence. The results show that the development of clinical reasoning and knowledge retention in the graduate nursing program requires a simulation-based curriculum
N=15 (Singapore)	Determine the knowledge and abilities needed to become an SP	In this study, we looked at how junior undergraduate nurses interacted with standardized patients. The objective was to evaluate the impact of the SP experience on the student's academic results. the question of whether a student's abilities and knowledge were improved as a result of taking on the role of SP during simulated professional learning and evaluation situations. This immersive, student-centred approach to simulation learning focused on emotive and cognitive learning in addition to the improvement of psychomotor abilities, which is the more typical result of simulation
HFS group N=50 LFS group N=51 (India)	Compare the development of newborn resuscitation abilities and their maintenance after three months	Both groups had comparable baseline written test scores (p=0.07), Megacode assessment scores (p=0.19), and sex distributions (p=0.17). At the post-test and after three months (retention), both groups showed a substantial improvement in both the Megacode assessment scores and the written exam score. The "improvement" between the two groups did not, however, vary significantly for either the written test (p=0.38) or the Megacode evaluation (p=0.92). Further evidence that these abilities were preserved at that time, irrespective of the option of self-learning them, comes from the fact that all post-test score for the 3 months was similar for both the abilities and their components
N=255 (South Korea)	Analyze the impact of combining clinical practice with simulated resuscitation training on students' knowledge, abilities, and self-confidence	After completing the clinical practicum, the mean comprehension and confidence evaluations significantly improved when compared with baseline (z=13.879, p.001 and z=10.969, p.001, respectively). On the analysis of covariance models, awareness (F=0.502, p=0.606), motor skill error (F=1.587, p=0.207) and self-efficacy (F=0.481, p=0.619) did not differ significantly across the three subgroups when two factors (age, Basic Life Support certification) were taken into account
Intervention group N=140, control group N=63 (China)	Improve students' clinical operating capacity	The student nurses had poor mean ratings on overall self-efficacy. Self-efficacy and success motivation had a very significant positive connection (r=0.432, p=0.000). The results revealed that age and educational attainment were more strongly correlated with self-efficacy than were gender and residence. Nursing employees should take action to boost new nurses' self-efficacy since performing so could motivate them to succeed. The enhancement of self-efficacy may also increase achievement motivation

Authors Hunag et al. (Hunag, et al., 2015) did the first research. The goal of the research was to ascertain how gender affected the evaluation of communication abilities in an Eastern nation. From a Taiwanese medical college, we attracted medical students in their fifth year. They were tasked with obtaining agreement from standardized patients who could be male or female and had ages that corresponded. Standardized checklist rating ratings and overall rating scores were used to evaluate their performance. Their performance was graded by neither male nor female examiners. 253 medical students in all were recruited, 166 of them were men and 87

of them were women. Male examiners' checklist rating ratings were considerably lower than female examiners' ratings when students interacted with males Male examiners had a P value of 0.006 whereas female examiners had a P value of 0.001. Male examiners scored significantly lower on the checklist for standard patients than did female examiners (male examiners, P=0.006; female examiners, P=0.008). Male students fared significantly worse than female students on the checklist evaluations for male usual patients when judged by male examiners (P=0.044). The general assessment scores were equal, except the finding that female students tended to associate with equal male and female SPs and received assessments from female examiners (P=0.004). The evaluation of communication abilities is influenced by the gender of the patients. Female standardizing patients seem to do better in relation to checklist rating ratings, perhaps reducing gender effects. The international rating system may be preferred to the checklist rating score in the best interests of the students, particularly for male test takers. Author Kim (Kim & Kim 2015) performed the second research. The goal of this research was to determine how adding a single simulation session to the pedagogic curriculum affected nursing students' ability to learn new information and develop their clinical reasoning abilities.

A quasi-ex cross-design with intervention and control groups drawn from the waiting list was used. The waiting list control group (Group B, n=46 participants) and the first intervention group (Group A, n=48 participants) were both assigned to the participants in a non-random manner. To determine knowledge level, a written multiple-choice test was used. To evaluate clinical reasoning skills, a nurse model-based scoring rubric was used. The level of self-confidence was assessed using a self-reported questionnaire.

In terms of capacity for analysis and relevant knowledge, students who took part in the virtual clinic group performed considerably superior to those who took part in the introduction lecture group; there was no difference in self-confidence ratings. The results show that the development of clinical reasoning and knowledge acquisition in school nursing education depends on the simulation-based curriculum. Author Mackey et al. (Mackey et al. 2014) performed the third study. In this research, we intended to determine if and if so, how, student nurses' involvement in simulation by acting as typical patients enhanced their knowledge and skill development. In 2011, fifteen senior undergrad nursing students participated in two focus groups, which generated data that was then thematically analyzed. The use of observational skills, reflection and appraisal, as well as seeing the nurse from the patient's eyes, were determined as the four key themes. Students had the chance to use the techniques of observing, deliberating and assessment while playing the part of the standardized patient to get fresh perspectives on their own practice, especially their communication abilities. Although senior student nurses' experience as standardised patients provided them with a variety of unique learning opportunities, additional study is required to ascertain how successfully this information is used when they become registered nurses in the future. Author Nimalkar et al. (Nimalkar et al. 2015) performed the fourth study. 101 college students were randomly allocated to the regular Resusci® Baby Basic and Sim NewB groups for a three-day randomized control experiment. While the lectures were similar for all groups, separate mannequins were used for the hands-on instruction. Five qualified professors with expertise and accreditation served as the students' instructors. Before and after training, as well as three months later, both groups got written tests, Mega codes and post-tests. Both groups had comparable baseline written test scores (p=0.07), Megacode assessment scores (p=0.19) and sex distributions (p=0.17). At the post-test and after three months (retention), both groups showed a substantial improvement in both the Megacode assessments score and the written exam score. However, for either the written test (p=0.38) or the Megacode evaluation (p=0.92), there was not a significant distinction in "improvement" between the two contrasted groups. Further evidence that the abilities were preserved after obtaining the option of self-learning them comes from the fact all of the post-test 3-month scores were equal for the skills in addition to the various content components.

Author Roh et al. (Roh et al. 2014) performed the fifth study. By evaluating nursing students' knowledge, psychomotor skills or self-efficacy, this study aimed to determine the effectiveness of combined simulation-based lifesaving skill development in conjunction with a clinical practicum. 255 second-year nurses took the emergency doctors practical course, which included an 80-hour clinical internship in an emergency department and a two-hour rescue education simulation component. We evaluated errors in general knowledge, self-efficacy and psychomotor competence. Data from the days before and after the test were analyzed for three subgroups: The simulation-only team, the reality-based simulation with clinical supervision group or the virtual world plus clinical efficacy group. The trainees were divided into three groups based on their encounters with revival throughout their clinical profession in the hospital's emergency room. Student nurses may benefit from combining simulation-based lifesaving abilities instruction and clinical experience in terms of increasing their mastery understanding and self-efficacy.

Author Zhang et al. (Zhang et al. 2015) performed the sixth study. The study's goal was to examine the general levels of self-efficacy or the relationship between that trait and success-related motivation among Chinese nurses in school. In all, 716 nursing students from 7 hospitals in western China took part in this study. The data were gathered using three scales: the General Data Scale, the Self-Efficacy Scale (SES) and the Achievement Motivation Scale (AMS). There were 566 trustworthy surveys in all. The student nurses' mean self-efficacy ratings were below average. Self-efficacy and success motivation had a very significant connection (r=0.432, p=0.000). Our research demonstrated that age and educational attainment were greater indicators of self-efficacy in both gender and residence. The nursing department should take action to boost student nurses' self-efficacy since doing so may raise their motivation to succeed. The enhancement of self-efficacy may also increase achievement motivation.

Discussion

The use of modelling in teaching and training for health professionals has become commonplace at many institutions of higher learning in the field of medicine. Evidence supports the educational strategy of simulation training for improving clinical knowledge and abilities. This study's primary objectives were to assess the quantity and quality of academic literature on training using simulation and to review the strongest supporting data presently available for the ability of simulation to boost medical students' clinical expertise, knowledge, and self-assurance. Core competencies and simulation modalities that impact a major role in the healthcare sector are the following: History and physical examination, teamwork and communication, patient education and counselling, diagnosis and clinical reasoning, procedure training, patient safety, documentation and IPEC competencies.

Bias assessment

The limitation of a comprehensive assessment of published research is the exclusion of unpublished data, which may lead to publication bias. Until recently, possible publication bias hadn't been examined using funnel plots or alternative corrective analytical techniques.

Conclusion

The simulation's grade in terms of patient safety is good. Since the creation of bench-top symposiums and analgesic scenarios, there have been quick technological advancements, more accessibility and a rising conviction that simulation is an effective and suitable method for educating future healthcare professionals. High-tech simulators are fascinating, but up until now, the majority of simulation advancements have been done *via* low-fidelity, low-cost methods. This is crucial because simulation has the ability to be employed on a global scale, eliminating the patient from the learning curve for healthcare professionals and enhancing patient safety. Fundamentals of Laparoscopic Surgery (FLS), a novel technique to evaluate proficiency in laparoscopic surgery, is an excellent

illustration of the rising usage of low-tech methods. Since July 2010, every finishing surgeon resident in the US has been required to have shown competency in FLS before completing an overall surgery residency, establishing a nationwide standard and objective benchmark. However, it is important to remember that simulation-based training in medicine should not be considered a magic solution or a quick fix for the present issues facing the healthcare system, such as patient safety concerns, working hour constraints, quality and service standards and the advent of new technology. It is doubtful that computerized simulations will replace the value of significant clinical experiences and learning from them, even while simulation-based training may undoubtedly eliminate the early stages of the learning curve, encourage the acceptance of safe practices and decrease patient damage. Additionally, clinical experience as opposed to repeated exposure in a virtual laboratory may be the only way to reach competence. Within training programs for physicians at all levels, simulation-based training must be completely incorporated and supported. Additionally, it is essential to teach the trainers by creating a faculty of qualified clinical facilitators, assisted by auxiliary support personnel in designated simulation suites. To enhance the usage of modelling is a tool for finding bad personnel, revalidating credentials, and uncovering new technologies, more research is required. Moving away from utilizing experience as a stand-in for competence and continuously evaluating a practitioner's abilities are also necessary. Thus, modelling can contribute significantly to the drive to develop a global healthcare system that will be safer for patients. The research study concludes that the area of professional development in simulation as fallow: Simulation training and certificate, technology skills, debriefing technique and feedback evaluation, curriculum development, inter-professional education, system Ingratiation, quality Improvement and research, scholarship, professional networking, reflective practices and mentorship.

Limitations of the study

Despite our best efforts, certain research limitations were inevitable. Only four sources were examined for qualified research since access to other potentially valuable databases for this study, such as EMBASE, was restricted. To find any publications that the first search approach missed, other sources were looked for. Studies that were evaluated could only be found online and could only have been written in English. Many papers were included for evaluation since their selection criteria were accessible to all JBI forms of evidence. This may have proved a benefit of the review, but much of the research was poorly designed. Since the criteria for inclusion for this investigation were restricted to student groups, it is possible that several research publications were disqualified due to the study's intended audience. There was yet another restriction.

Future Research

A quality development framework is necessary for the development and execution of simulators for health education utilizing solid research designs. To develop recommendations for creating and authoring simulation studies, further study is required. Although acting as SPs may be advantageous for students, it's important to use discretion when selecting individuals to mentor and assess their fellow students. Numerous studies support the employing of thought as a method for teaching and developing students' capacity for critical thought. All simulated learning and training exercises need to employ planned debriefing sessions. When necessary, it is crucial to employ verified outcome measures to eliminate any possible bias. IPE/IPP simulation research is needed because simulation is an effective teaching and learning approach for achieving IPE goals and preparing any medical students to collaborate safely in IPP contexts. A future version of simulation in healthcare: Simulation of simlabs, creation of a pool of skilled faculty and collaboration learning and interdisciplinary integration, shaping national standards for simulation excellence, global collaboration for unified healthcare accreditation framework and simulation will act as a catalyst for continuous improvement and quality assurances sustainable and progressive healthcare ecosystem.

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