REVIEWS

Effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development, in low- and middle-income countries: A systematic review

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ABSTRACT

Objective: The development of a body of knowledge in simulation pedagogy is a source of enrichment of teaching methods, beneficial for the professional training of nurses and midwives. This review synthesized the effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in low- and middle-income countries (LMICs).

Methods: The search for primary research papers was conducted in PubMed, CINAHL, ERIC, and EMBASE. For additional papers, hand-searching was performed in key journals. All studies published in the English language between 2011 and 2020 were included. Titles and abstracts were screened after removing duplicates and then full texts of the remaining studies. Thirteen research studies were initially selected for a full review, with fifteen studies that fulfilled inclusion criteria included in the final analysis. The quality of studies was appraised using the Mixed Methods Appraisal Tool. A narrative approach was used for synthesizing data.

Results: Of the fifteen primary studies included in the review, there are three qualitative studies, ten quantitative studies, and two mixed methods studies. Among these studies, five were conducted in Turkey, three in South Africa, two in Ethiopia, one in Jordan, one in Kenya, one in Zambia, one in Brazil, and one in China. Student-level outcomes measured included knowledge, attitudes, skill performance, and satisfaction. Most of the outcomes at the reaction level demonstrated students' satisfaction. At the learning level, outcomes involve knowledge (knowing), attitudes (feeling), and skills (doing).

Conclusions: Educators and researchers in undergraduate education programs need evidence to inform best practice strategies for students' skill development. This research presents preliminary evidence of the effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development on satisfaction, knowledge, attitudes, and skills. In addition, it could enlighten policymakers, managers and educators in LMICs countries on the need to use simulation pedagogy in nursing and midwifery professional training institutes.

Key Words: Simulation pedagogy, Skill development, Undergraduate nursing students, Undergraduate midwifery students, Educators, Low- and middle-income countries

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1. INTRODUCTION

Nowadays, simulation utilization in healthcare has grown considerably and is now more important in nursing and midwifery education.[1–5] Simulation is recognized as a valuable and effective general tool in acquiring knowledge.[6,7] It helps to expand and consolidate the students' knowledge, lay the bridges for the action, award value, and promote its relevance.[8,9] It is an excellent educational strategy to help students in nursing and obstetrics develop ethical attitudes and behaviours and apply ethical principles in clinical practice.[10] Using simulation increases students' motivation to learn[11] and their satisfaction with learning.[7,12] Satisfaction with skills lab training was found to be high.[13] The satisfaction level concerns not only the materials, instruments, and interactive simulators available but also the trainer's expertise, accessibility, and communication.[14] A learning environment that promotes satisfaction improves motivation to study and increases the achievement of expected learning outcomes.[10] Simulation promotes the creation of such environments.[15] Repeated simulation experiences increase students' self-confidence levels.[9,16,17] Simulation is considered an active learning strategy in training[18] and a viable option to complement clinical practice.[19] It is increasingly used as a teaching method to develop students' skills to connect theory and practice.[20] Challenges related to clinical sites and opportunities for students to gain clinical experience are increasingly a concern for many educators.[21] The reduction of hospitalization length, the restructuration of clinical settings, and the shortage of qualified faculty have resulted in limited clinical practice hours and clinical placements.[22] Indeed, not all care environments offer sufficient learning opportunities to meet internship objectives.[23,24] Simulation allows the learner to acquire essential skills in a close-to-reality environment.[25] Several studies have demonstrated the effectiveness of simulation training in nursing and obstetrics, both in technical and non-technical skills.[26,27]

While simulation training has increased in its extent and scope in many nursing and midwifery training programs in Europe, the United States, Asia, the Middle East, and Australia, literature shows a lack of implementation and research on simulation in low and middle-income countries (LMICs).[28–33] To our knowledge, a dearth of research highlighted the effects of simulation use in undergraduate nursing and midwifery students' skill development. As underlined by Zaugg and al., the systematic review makes it possible to provide exhaustive and objective information quickly.[34] Therefore, this research could enlighten policymakers, managers, and educators in LMICs on the need to use simulation pedagogy in undergraduate nursing and midwifery training institutes. According to Campbell and Daley, the term simulation pedagogy is used throughout the study to "describe a method of utilizing simulation and scenarios to integrate content and multiple concepts in all areas of nursing care to provide an interactive environment by which students are held accountable to use the information they are learning".[35] This systematic review synthesized the effects of simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in LMICs. It was undertaken to answer the following question: What are the effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in LMICs.

2. METHOD

This systematic review's protocol was registered in the International Prospective Register of Systematic Reviews (Prospero) (CRD42020207397). We followed the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P) guidelines throughout the process.[36]

2.1 Inclusion and exclusion criteria

Studies that explore the effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in LMICs, published in the English language between 2011 and 2020, were included. All research designs have been considered. Editorials, commentaries, literature reviews, and non-English language articles were excluded.

2.2 Search strategy

A two-step search strategy was used to obtain the relevant studies. The first step involved searching in PubMed, CINAHL, ERIC, and Embase. A specific search strategy was developed for each database. The second step involved handsearching for two key journals devoted to health professions simulation (Clinical Simulation in Nursing and Simulation in Healthcare) and another key journal: Academia.edu. References of highly cited key papers were also checked. Of one hundred thirty-three research studies, thirty-three were initially selected for a full review, with fifteen studies that fulfilled inclusion criteria included in the final analysis.

2.3 Screening and selection of studies

Titles of the studies were screened after the removal of duplicates. The main author (YP) initially screened all titles and abstracts. Studies that are not relevant to the research question and duplicates were eliminated at this stage. Then, two review authors (NB, PG) independently screened titles and abstracts retrieved by the search. Full reports for all references that meet the inclusion criteria were obtained. Finally, full articles were reviewed by the three review authors (YP,

NB, PG), and those which fulfilled inclusion criteria were included.

2.4 Assessment of methodological quality

Two independent reviewers (YP, NB) used Mixed-Methods Appraisal Tool (MMAT)[37] to appraise the methodological quality of the selected studies before inclusion in the review. All discrepancies were resolved by the intervention of a third reviewer (PN).

2.5 Data extraction and synthesis

2.5.1 *Data extraction*

Data extraction was performed by two review authors (YP, NB). It included specific details about the first author's name, publication year, country, setting, study design, data collection, data analysis, participants, intervention, control, and any outcomes of significance to the review's aim. The two reviewers pilot-tested the data extraction form on the first three included studies. A third experienced co-author (PN) has overseen the data extraction process and was available for consultation.

2.5.2 *Data synthesis*

A narrative approach was used for synthesizing data. The relations and findings within and between studies were explored based on the 'Guidance on the Conduct of Narrative Synthesis in Systematic Reviews'.[38] Findings were presented in Appendices. They were categorized on the Kirkpatrick's Scale Levels of Evaluation Model at level 1 (Reaction) and level 2 (Learning) to help recognize trends in the data.[39] Evaluation outcomes include affective or instrumental at the reaction level and involve attitudes, knowledge, or skills at the learning level.

3. Results

3.1 Overview of studies

Inspired by Moher and al., Figure 1 shows the process followed to identify relevant studies.[40] Databases and other sources searching yielded one hundred thirty-three studies. This pool of studies was reduced to thirty-three following a review of titles and abstracts. After full-text reading of the thirty-three studies, fifteen were finally selected for review.

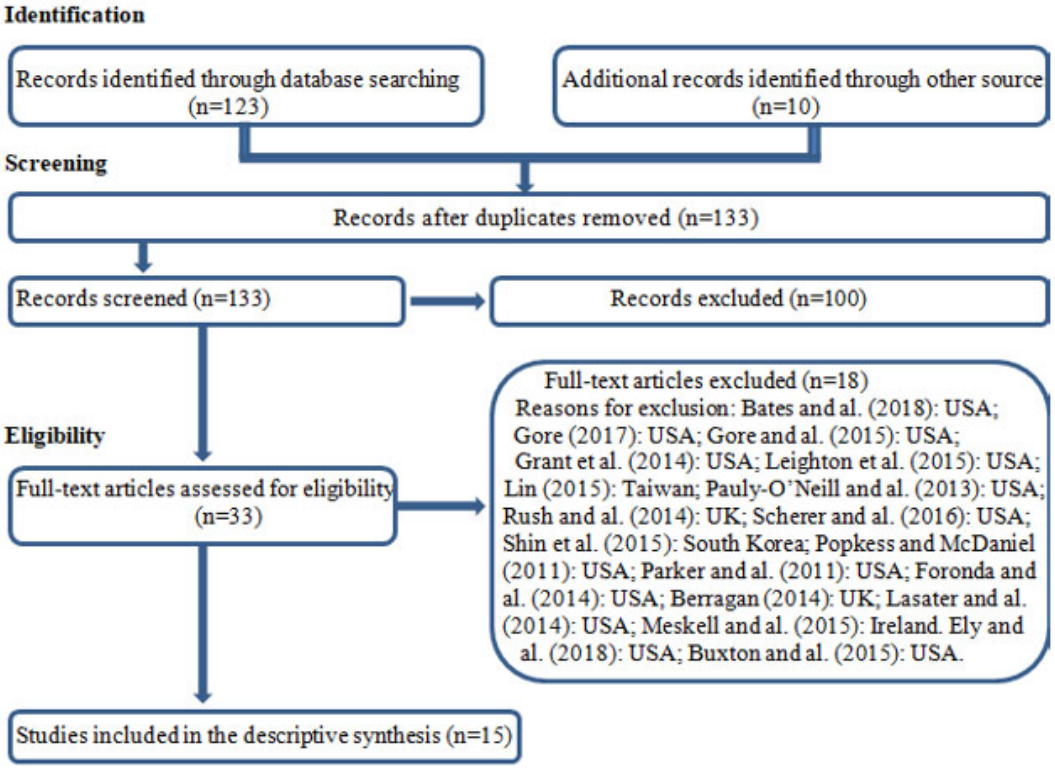

Figure 1. PRISMA flow diagram, (from Moher et al., The PRISMA Group (2009))

Appendix 1 presents the study author(s) and the publication date, the study design, the participants, the study purpose, the data collection, the analysis, the intervention, the control, and the outcomes for each study.

As shown in Appendix 2, of the fifteen studies included in the review, there are three qualitative studies; ten quantitative studies, including two randomized controlled trials, four quasi-experimental studies, four descriptive quantitative stud-

ies; and two mixed methods studies. Among these studies, five were conducted in Turkey, three in South Africa, two in Ethiopia, one in Jordan, one in Kenya, one in Zambia, one in Brazil, and another one in China. Student-level outcomes measured in the articles take into account knowledge (ten), attitudes (thirteen), skill performance (nine), and satisfaction (eight). All selected articles are in English and published from 2012 to 2020 in LMICs. In addition, the sample sizes of included articles were between thirty-six and four hundred.

3.2 Methodological quality

As shown in Appendix 3, three qualitative studies scored five out of five. Two randomized controlled trials scored four out of five; two quasi-experimental studies scored five out of five, and two scored four out of five. Four descriptive quantitative studies scored five out of five, and two mixed methods studies scored four out of five. Given the few number of relevant studies in this systematic review, all fifteen relevant studies were accepted.

3.3 Findings of the review

The review findings were categorized according to Kirkpatrick's scale Levels.[41]

As shown in Appendix 4, the effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development concern four categories: Satisfaction, Knowledge, Attitudes, and Skills.

3.3.1 *Satisfaction*

Several studies demonstrated that undergraduate nursing and midwifery students' have satisfied with the simulation participation (Tyer-Viola et al., 2012; Gudayu et al., 2015; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Cura et al., 2020; Souza et al., 2020). Among those, four studies (Nyamu et al., 2018; Crafford et al., 2019; Cura et al., 2020; Souza et al., 2020) addressed the nursing students' satisfaction, and three studies (Tyer-Viola et al., 2012; Gudayu et al., 2015; Amod & Brysiewicz, 2017) explored the midwifery students' satisfaction. Nyamu and al. (2018) also explored the perceptions of nursing tutors on simulation models. The study's findings showed that most respondents (85%) strongly agree that simulation allows students to achieve learning outcomes. While some studies focused on a single simulation modality, other studies, such as that by Cura and al. (2020), compared the effects of different simulation modalities (SPs, HFS, and partial task trainer). The study's findings revealed a significant difference between nursing students in the SPs, HFS, and partial task trainers regarding satisfaction scores in learning. After the practice, the SPs group's satisfaction mean scores were significantly higher than those of the other two groups. These studies associated the assessment of satisfaction with other effects of the simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development. Specifically, the study findings by Souza and al. (2020) revealed a significant and positive association between satisfaction and self-confidence. This shows that the nursing student's level of satisfaction and self-confidence increase together.

3.3.2 *Knowledge*

Many articles have measured undergraduate nursing and midwifery student's knowledge acquisition (Akhu-Zaheya et al., 2012; Tyer-Viola et al., 2012; Badir et al., 2015; Tuzer et al., 2016; Amod & Brysiewicz, 2017, 2019; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020). Among those, six studies (Akhu-Zaheya et al., 2012; Badir et al., 2015; Tuzer et al., 2016; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020) addressed the nursing students' knowledge, and three studies (Tyer-Viola et al., 2012; Amod & Brysiewicz, 2017, 2019) explored the midwifery students' knowledge. While some studies focused on a single simulation modality, in other studies, such as those by Tuzer and al. (2016) and Cura and al. (2020), different simulation modalities were used. Indeed, Tuzer and al. (2016) compared the effects of using the HFS and SPs on nursing students' knowledge of conducting thorax-lungs and cardiac examinations, and Cura and al. (2020) used the SPs, HFS, and partial task trainer. The study's findings by Cura and al. (2020) showed an increase in post-practice knowledge levels of the three groups with similar knowledge levels before the practice. Those of the study by Tuzer et al. (2016) revealed an increase in knowledge and performance scores of all students after the simulation. However, nursing students with SPs had significantly higher knowledge scores than nursing students with HFS. On the other hand, Tyer-Viola and al. (2012) examined if adding a simulation intervention before having a clinical rotation in the hospital setting improved knowledge of antenatal evaluation and showed no difference in knowledge between the simulation group and the standard clinical education. Likewise, in terms of knowledge acquisition or retention, the study findings by Akhu-Zaheya et al. (2012) did not find significant differences between groups of nursing students.

3.3.3 *Attitudes*

Most often, confidence and self-efficacy are the attitudes measured as simulation results. Many studies have found a significant increase in the overall confidence of undergraduate nursing and midwifery students after participating in a simulation (Tyer-Viola et al., 2012; Badir et al., 2015; Gudayu et al., 2015; Sarmasoglu et al., 2016; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020; Souza et al., 2020).

Among those, seven studies (Badir et al., 2015; Sarmasoglu et al., 2016; Nyamu et al., 2018; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020; Souza et al., 2020) addressed the nursing students' confidence, and three studies (Tyer-Viola et al., 2012; Gudayu et al., 2015; Amod & Brysiewicz, 2017) explored the midwifery students' confidence. While most studies focused on the effects of single or different simulation modalities, Tyer-Viola et al. (2012) evaluated the effect of simulation on knowledge between midwifery students who have experimented with simulation and those who have followed traditional education. Specifically, according to Amod and Brysiewicz (2017), using HFS in the simulation learning package on post-partum haemorrhage increased the midwifery students' self-confidence during the post-simulation.

Simulation effects on undergraduate nursing and midwifery students' self-efficacy were reported in only three studies (Akhu-Zaheya et al., 2012; Gudayu et al., 2015; Karabacak et al., 2019). The study by Akhu-Zaheya and al. (2012) and that by Karabacak et al. (2019) concerned the nursing students' self-efficacy, and the study by Gudayu et al. (2015) explored the midwifery students' self-efficacy. However, while Akhu-Zaheya and al. (2012) found that the independent t-test showed a significant difference in self-efficacy in high-fidelity basic life support between the experimental and the control group, Gudayu et al. (2015) showed that the level of self-efficacy of simulation-based teaching (SBT) among Midwifery students is low. Similarly, the study findings by Karabacak and al. (2019) showed that the mean self-efficacy score of nursing students decreased from pre-scenario to post-scenario.

3.3.4 *Skills*

During simulation, technical or clinical skills such as venipuncture, intubation or intravenous therapy,[8] non-technical skills such as communication, leadership, and decision-making,[42] and cognitive skills such as critical thinking are skills or behavioural performance frequently measured. Studies showed a diversity of outcome measures on skill performance in our review. Technical skills and non-technical skills were both explored by several studies (Badir et al., 2015; Sarmasoglu et al., 2016; Tuzer et al., 2016; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020). Among those, seven studies (Badir et al., 2015; Sarmasoglu et al., 2016; Tuzer et al., 2016; Nyamu et al., 2018; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020) addressed the nursing students' skills, and one study (Amod & Brysiewicz, 2017) concerned the midwifery students' skills. Most of these studies revealed that using simulation in learning improves students' clinical skills post-simulation. For instance, according to Tuzer et al. (2016), nursing students who studied with HFS and SPs expressed that simulation improved skills, especially communication skills. Amod and Brysiewicz (2017) revealed that using HFS improved midwifery students' clinical skills. In Teni and Gebretensaye (2019) study, most nurse educators (83.8%) agreed that clinical simulation improves nursing students' skills. Three studies explored critical thinking and showed that simulation stimulates it (Amod & Brysiewicz, 2017) or promotes it (Nyamu et al., 2018), or again improves it (Teni & Gebretensaye, 2019).

4. DISCUSSION

4.1 Review findings

When using simulation in nursing and midwifery pedagogy, the outcomes can be affective or instrumental at the reaction or satisfaction level.[43] Most of the findings from this review show that undergraduate nursing and midwifery students are satisfied with all the simulation modalities using skill development and feel that these simulation experiences contributed to their learning. As many authors have pointed out in the existing literature, simulation utilization as a teaching strategy increases learners' satisfaction with learning.[7, 12, 44–47] According to Baptista and al., students' satisfaction is a significant result. Indeed, it is associated with greater involvement and motivation in the simulation learning process.[48] In addition, it allows well-evaluating teaching, teachers, and training institutes. It promotes qualitative improvements in teaching due to the increasing consideration of the student's point of view as an actor in educational services.[48] Martins and al. also point out that student satisfaction enhances their motivation for study and increases learning outcomes.[10] Using simulation pedagogy in students' skill development promotes the creation of such environments.[15]

At the learning level, outcomes can concern knowledge (knowing), attitudes (feeling), or skills (doing).[49] Concerning students' knowledge, most of the studies that explored knowledge acquisition showed an increase in knowledge following simulation. Much of the existing literature also reports a significant increase in students' knowledge acquisition following participation in the simulation.[47, 50–54] In terms of attitudes, most studies that explored attitudes revealed an increase in confidence to follow simulation. As many authors pointed out in the existing literature, simulation utilization as a teaching strategy is helpful for students to develop a feeling of confidence in facing a similar setting in the future or increases students' confidence.[1, 16, 17, 44, 47, 51, 55] According to Larue and al., student self-confidence impacts their clinical skills and competency in responding to the

needs of patients.[56] However, research exploring critical thinking and competence in undergraduate nursing and midwifery students remains sparse and inconclusive on skills. The three studies in this review that explored critical thinking showed that simulation stimulates critical thinking and promotes or improves it. These findings are similar to those of Goodstone and al., Loke and al., and Stoodley and al.[54,57,58] Edward and Chukwuka claim that students' critical thinking and reflection skills should be emphasized and taught by educators. This will help them graduate from lower-level cognitive skills to a higher level.[25]

The scientific literature increasingly provides evidence of the effectiveness of simulation on learning outcomes in health education. Our findings parallel those of a systematic review by Cant & Cooper on simulation-based learning for nursing education. His review demonstrated a positive effect of HFS on learner satisfaction, knowledge, attitudes, confidence, and skills, including critical thinking.[59] According to Peddle and al.'s findings, interactions with virtual patients influence learning knowledge, attitudes, and non-technical skills such as communication, teamwork, leadership, and decision-making in undergraduate nursing students.[60] Other studies also indicated that the simulation pedagogy utilization in nursing and midwifery students' skill development improves knowledge, clinical practice, clinical competence, critical thinking, communication skills, self-confidence and satisfaction.[7,12,57,61,62] This review presented similar findings showing simulation effects on satisfaction (reaction level) and knowledge, attitudes, and skills (learning level) outcomes described in Kirkpatrick's model. Widely recognized, the World Health Organization considers this model the standard reference for learning assessment.[63]

4.2 Limitations

All papers included in the review were published in English. Therefore, other relevant papers might have been excluded. As only papers published between 2011 and 2020 were included, relevant papers published before 2011 and after 2020 have been missed. As only fifteen primary research papers were included, it is impossible to draw appropriate findings based on the limited quantity and quality of available evidence. Therefore, despite applying a comprehensive search strategy, we are unsure that all relevant studies were identified and included in this review.

4.3 Implications for nursing and midwifery education future

As a teaching and learning strategy, simulation utilization increases worldwide in undergraduate nursing and midwifery degree programs.[64,65] This review presents the best evidence of simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in LMICs. It suggests that simulation improves learning outcomes related to knowledge, attitudes, self-confidence, self-efficacy, and skills, namely, critical thinking, clinical competence, and skill performance. Findings also show high student satisfaction with simulation experiences. Therefore, simulation pedagogy can be used in professional training institutes if integrated appropriately as an active learning strategy. As Edward and Chukwuka reported, training faculty members in the effective use of simulators must be an important challenge.[25] In the context of LMICs, it would be up to decision-makers, managers, and educators to provide nursing and midwifery professional training institutes with well-equipped and functional skills laboratories.

4.4 Implications for research

This review has shown a lack of studies on the effects of simulation pedagogy in undergraduate nursing and midwifery students' skill development in LMICs. In addition, only one study reported the barriers to implementing clinical simulation pedagogy: time spent on preparation, lack of support by faculty, lack of training and knowledge, lack of space, lack of equipment, lack of funding, cost of simulation equipment, and lack of motivation. This finding calls for more and better research on the effects of simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development and the barriers to using best simulation practices in LMICs.

5. Conclusion

This systematic review aimed to synthesize the best available evidence on the effects of simulation pedagogy utilization in undergraduate nursing and midwifery students' skill development in LMICs. Specifically, this review provided preliminary evidence on satisfaction, knowledge, attitudes, and skills. With the increasing complexity of healthcare and the rising number of nursing and midwifery students, simulation pedagogy may be a key component to preparing students for clinical practice adequately. Therefore, educators play a leading role in implementing best educational practices that enhance students' learning in a safe environment. Educators and researchers in undergraduate education programs need evidence to inform best practice strategies for students' skill development. Furthermore, health schools should ensure that educators have enough simulation skills to meet students' needs. This research could enlighten policymakers, managers, and educators in LMICs on using simulation pedagogy in nursing and midwifery professional training institutes.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that they have no conflict of interest.

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