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Review Article

The Effectiveness of Simulation Training on Nursing Students' Neonatal Resuscitation Skills: A Systematic Review

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Abstract

Background: Many research studies exist which highlight the benefits of simulation training for healthcare professionals. Simulation not only helps students to engage more with the curriculum, but also enables them to apply theoretical learning to real practice within a safe environment. During the first year of nursing, it is especially crucial that students engage with the learning process and adjust to complicated medical scenarios. Simulation has been found to be a valuable way to improve practical skills, and could be especially effective in training the neonatal resuscitation skills of student nurses.

Objective: The aim of the review is to investigate whether simulation training helps first-year nursing students to learn and develop neonatal resuscitation skills.

Method: An extensive literature review was conducted by investigating relevant research studies related to resuscitation training of first-year nursing students. Medline and CINHAHL databases were searched using relevant keywords to locate a range of research papers. Six research articles were selected from amongst the various studies. Of these, one was a systematic review, one a case study, one a quasi-experimental study, and three were Randomised Control Trials (RCTs). All of these publications were analyzed using the Critical Appraisal Skills Program (CASP).

Results: The six research articles which were analyzed all supported the inclusion of simulation training in nursing education as a way of enhancing the skills, satisfaction and confidence of the students.

Conclusion: The evidence indicates that simulation training helps to ensure that students receive real-life practice, which supports the development of neonatal resuscitation skills. The review shows that the skills, confidence and satisfaction of trainees significantly improve because of simulation training. Findings from this review could be used to persuade the Ministry of Health in Saudi Arabia that simulation may be an important learning tool in nursing education, especially in training neonatal resuscitation skills, and that such training could result in lower mortality rates in newborn infants.

Keywords: First year nursing students; Simulation; Skill; Neonatal resuscitation; Training

Abbreviation: AAP: American Academy of Paediatrics; AHA: American Heart Association; HFM: High-Fidelity Manikin; LFM: Low-fidelity Manikin; MFM: Medium-fidelity Manikin; NICU: Neonatal Intensive Care Unit; NRP: Neonatal Resuscitation Program; RCTs: Randomised Control Trails; SR: Systematic Review; EM: Emergency medicine

Introduction

The aim of this chapter is to provide a brief overview of several of the most prominent simulation techniques and approaches referred to in the existing literature. In view of this, Section 1.1 will define the key differences between low-, medium-, and high-fidelity mannequins, and this will be followed by a discussion of how simulation practices drawing on these devices can benefit the intervention in question (Namely, neonatal

resuscitation). Following this, the author will illuminate issues relating to the background of the proposed systematic review, and information will in turn be given to outline the rationale for the present document, which seeks to gain insight into the literature specifically pertaining to simulation training in the context of neonatal resuscitation. After this, the aim and objectives of the present review will be given, and these sections will then be followed by a series of concluding remarks.

Overview

According to a recent report published by the American Heart Association [1], breathing assistance is required by at least 1 in every 10 new-born infants. In view of this, it is similarly important to recognise that 10% of all of the infants who require breathing assistance immediately after birth also need to undergo 'extreme medical procedures' in order to survive. It should be noted that procedures of this kind are conventionally referred to as 'neonatal resuscitation'. Considering statistics such as these, many researchers, including Rovamo, et al. [2], have argued for the notion that neonatal resuscitation should be a fundamental element of the training programmes that nursing students participate in to gain their qualifications. Currently, as per the recommendations made by scholars such as Fountain, et al. [3] and Marshall, et al. [4], nursing and midwifery students are expected to receive training and education regarding the various techniques and methods that can be applied to facilitate the revival of new-borns. As stated by Marshall, et al. [4], the first year of nursing and midwifery education is crucial in establishing students' practical competencies in dealing with emergency situations such as neonatal breathing difficulties. However, Mannix [5] points out that in practice this objective is not always met by training programmes. Marshall, et al. [4] argue that neonatal resuscitation training is highly complex and requires nurses to draw on a range of different practical methods as well as theory learned from lectures and lab sessions. In this context, simulations have often been recommended as a potentially useful pedagogical tool, especially in view of the recent introduction of advanced technologies in this field [6].

It is generally acknowledged that the incorporation of simulation-based training sessions into educational programmes can be useful in helping students to learn how to handle challenging situations in an appropriate way. One such situation is the resuscitation of new-born babies who are experiencing breathing difficulties. Simulation training gives students a safe and controlled environment in which they can apply theoretical learning in a highly-charged emergency situation without risk to patients' lives [7]. At present, a range of such practical approaches have been devised, including simulations that involve mannequins of varying fidelities (High, medium and low). Low-Fidelity Mannequins (LFMs) are defined as static models with body parts manufactured from rubber, and they are primarily beneficial in enabling nursing students to acquire basic clinical skills [8]. In contrast to LFM, Medium-Fidelity Mannequins (MFMs) are full-body mannequins operated via an external handheld console and are used to aid students in the improvement of their practical medical skills [9]. In terms of the practical skills which MFMs can be used to develop, evidence suggests that examination skills related to bowel sounds assessment and cardiac auscultation have benefitted considerably. Marking a contrast to both LFM and MFM, High-Fidelity Mannequins (HFMs) are computerised models, the purpose of which is to provide representations of realistic anatomical structures and, in this way, give out high-fidelity responses [10]. With reference to the aims of the present study, we can see that HFMs enable students to gain insight into resuscitation interventions in a real-world environment [11].

Background

In discussing some of the historical applications of simulation technology, [12] draws attention to the fact that cutting-edge techniques and methods were applied during the Second World War (1939-1945) for the purpose of training fighter pilots. Motivated by a recognition of the highly-damaging impact that ineffective preparation could have on the pilots, the simulations drew on – and accurately replicated – common real-life obstacles (Such as poor weather and engine power failure) for the pilots, thus allowing them to practice real-world simulations without the need to risk their lives in any way.

Reflecting on applications such as these, similarly stressed the idea that preparation for emergency scenarios (Or example, those in which it is expected that teams of doctors, paramedics, firefighters, or military personnel might become engaged at some future date) can be made more effective by capitalising on the benefits associated with simulation practice. In clinical contexts, the degree to which the services rendered to service users are reliable, effective, and consistent can be increased if healthcare personnel have prepared for all eventualities by way of simulations, and so it is expected that the application of simulation training in these areas will ensure that the paramount requirement of patient safety is met. The above fact is supported by the Institute of Medicine (IOM) and Kohn, et al. [13]. In both cases, the authors explain that the benefits yielded by the application of simulation-based training in healthcare contexts can safeguard against clinical error. This is because simulations provide an accurate and safe training environment for the event of acute paediatric emergency, in which healthcare personnel can become adept at implementing the required procedures without endangering the life of a child. In the last ten years, various researchers, including Deegan, et al. [14], Reynolds, et al. [15], and Tyer-Viola, et al. [16], have endorsed the fact that nursing and midwifery skills training display gradual enhancements when the utilisation of lifelike models (In particular, models which respond in a physiologically realistic

manner) is established in training.

According to Gaba [17], the practice of simulation refers to an instructional process wherein a real patient is substituted for a dummy (Or a mannequin, a human actor, or a computerised patient), with the intention being able to accurately 'emulate patient care scenarios in a tangible setting so as to offer effective evaluation and feedback'. In a similar manner, Cioffi [18] defined simulation as the intentional establishment of a scenario, environment, or phenomenon, the primary purpose of which is to depict (in an accurate way) the 'real-life that it aims to emulate'. One of the key factors of simulation learning, as explained by Issenberg, et al. [8], is the way in which repetition takes place consistently. This is beneficial because it allows the student to develop both technical and non-technical skills, thereby increasing the degree to which they are competent in that scenario. Hence, simulation is one of the key elements in the collection of teaching methods and pedagogical practices used to adequately prepare students for real-world clinical environments.

Haemorrhage and resuscitation techniques are among the emergency situations that students and others can learn and practically apply through role-play and rehearsal. Kerr, et al. [19] stated that one of the positive aspects of simulation is the opportunity it provides for students to 'explore initial reactions', a key component of the learning process. Furthermore, the 'learning by doing' strategy is also promoted, as this method provides tangible learning, which Kerr, et al. [19] link to 'real clinical scenarios'. The authors (ibid) also explain how simulation allows midwifery students to use 'experiential learning and apply their knowledge and skills'. These points were taken up in the more recent study conducted by Garret, et al. [20], who found evidence to suggest that simulation provides a 'safe, representative environment that accurately depicts the clinical setting, without risking the lives of a mother and child'. This view was endorsed in the earlier study conducted by Dow [21], and it was also corroborated by the research published by Osman, et al. [22], which noted that improved performance in clinical emergencies can be expected from nurses and midwives as a result of this training method. According to Broussard [23], knowledge retention has significantly benefited from the introduction of simulation-based teaching. Similar results are seen during the practical technical application of skills such as patient assessment [24], as well as overall clinical performance. Meyer, et al. [25], Gudhe [26], and Rochester, et al. [27] have all contended that students find the sessions enjoyable and satisfying, and in many cases, as an excellent preparation method for the real-life clinical practice that follows.

Thus, due to its highly-rated effectiveness, the use of simulation has increased in midwifery education. However, there is no conclusive evidence regarding the question as to whether it should be introduced as a regular aspect of training for nursing students. In view of this, the purpose of the present dissertation is to account for this gap by exploring whether the inclusion of simulation training yields significant outcomes for nursing students or not.

Rationale

Children are anatomically and physically dissimilar to fully-grown adults, and this can prove to be a major issue for healthcare educators, especially when teaching students how to care for critically ill children [13]. However, by capitalising on the above-mentioned benefits of simulation-based teaching, theoretical knowledge can be tested in a practical environment by nurses. Simulations of neonatal resuscitation can provide an opportunity for students to learn essential critical thinking skills, and it is also the case that one of the major benefits of simulation is the way in which it allows students to become familiar with complex medical contexts [28]. Ultimately, nursing students are encouraged to understand that simulation training is an effective way of preserving patient safety, since any initial mistakes can be corrected in the role-play situation, and pose no risk to real patients. In this context, evidence has been published to suggest that irrespective of the uncomplicated or complicated nature of a simulated environment (For example, role-playing events), training which relies on simulations can improve the effectiveness of the learning process [26]. However, the same study highlighted that the simpler the process of simulation-based training, the more effective the matter of satisfying learning objectives (ibid). According to the researcher, one of the key ways in which simulation-based teaching benefits the timely acquisition of new knowledge and practical skills is by exposing student participants to an entire clinical block as well as theoretical simulations (A practice which takes place simultaneously) (ibid). As a result of this, the students can encounter a greater number of clinical cases in a shorter space of time. In addition to this, a lack of preparation for new nursing students often translates into the phenomenon of culture shock when they are first exposed to a maternity unit's clinical environment [29]. Crucially, culture shock of this kind is often correlated with the high drop-out rate of nursing students in their first year of university. In view of these considerations, the employment of simulation techniques may help students who would otherwise drop out in dealing with the issue, primarily by preparing them more effectively for their first encounter with the real setting. Hence, when examining the role played by simulation training among individuals who are in the process of studying to become professional nursing practitioners, it becomes essential to understand whether simulation training should be introduced in nursing education, especially in the first year.

In the context of the Kingdom of Saudi Arabia, there are no clear guidelines about the best approach for simulation training in the domain of neonatal resuscitation. Moreover, no systematic

review of this has ever been carried out for the Saudi Arabian context, thus highlighting the urgent need for research in this field. In addition, in view of the literature cited above, there is compelling cause for considering that simulation-based teaching could serve as a uniquely-powerful pedagogical tool for acute and emergency healthcare. Furthermore, it is worth considering the degree to which this approach could be useful in neonatal contexts, primarily because it could help to support student nurses in applying theory to practice within a challenging situation, such as neonatal resuscitation. Hence, the findings of the present study will assist nursing institutions in taking an informed decision regarding the introduction of simulation training, specifically within the first year of nursing education.

Aim

To identify and review the best available evidence regarding the effectiveness of neonatal resuscitation simulation in improving the skills of first-year nursing students.

Objectives

To search for existing studies on the use of simulation in neonatal resuscitation training (the search protocol will focus on all available online databases, including CINAHL, ProQuest, PubMed, and MEDLINE). To offer suitable recommendations for improving nursing education based on the findings of the systematic review.

Summary

The purpose of the present chapter has been to provide an introduction and overview regarding the use and benefits associated with practical simulation as a training method that can be beneficially employed in the context of nursing education. In Sections 1.1, 1.2, and 1.3, a brief examination of the existing literature relating to this area was investigated, and it is possible to conclude in view of the findings that simulation-based teaching represents a uniquely effective way in which to improve training outcomes for first-year nursing students in university. The preliminary sections in the present chapter also emphasised that simulation-based teaching can serve as a highly effective way to contribute to training in the area of neonatal resuscitation for trainee nurses. In the concluding sections of this chapter, the study's aim and objectives were given. In the next chapter, the author will outline the methodology employed to accomplish the above-mentioned research objectives.

Methodology

Introduction

This chapter provides an overview of the approach that was used for the Systematic Review (SR). The chapter includes the methodology that was applied to locate evidence about whether simulation of neonatal resuscitation technique improves resuscitation skills among first-year nursing students. This will then be followed by critical analysis of the selected studies in terms of understanding and assessing the quality of the research.

Study Design

The review has used a systematic process to locate relevant evidence. SRs can help clinicians remain up-to-date about their field and assist in developing relevant clinical practice guidelines [30]. According to Higgins [31], the data gathered for a SR should employ specific relevant search terms along with the use of a methodical, reliable and precise search process to unite existing information and research literature. This SR analyses six studies which used a variety of research designs, and which were searched for using particular keywords from specific databases as described in the following sections.

Search Strategy

Paul (2012) states that the huge amount of material that is accessible in databases, as well as significant variations between the published works, can cause search strategies to take up a significant amount of time and effort. In the absence of a robust search strategy, irrelevant and inaccurate data could be collected and incorporated in a review [32]. Therefore, this assessment utilised a systematic method for its search strategy to make sure that all related information was gathered in the most efficient manner. Aveyard [33] asserts that the employment of a successful search strategy is paramount in ensuring that a researcher can locate and make use of the correct studies and relevant information. To ensure relevancy, only studies by well-known authors in the field were selected [34]. In this review, electronic searches were adopted to retrieve relevant papers that could be used as a source of information. Whilst electronic databases have been cited as one of the most valuable resources to be utilised when researching existing appropriate literature [35], a search within these databases may not identify all related papers. The search tools within the electronic database may be flawed and fail to give accurate results [36]. This necessitates further manual searching by going through the references mentioned in the selected articles.

Developing the Search Question

Richardson, et al. [37] suggests that in order to facilitate a search strategy it is essential to develop a search question. According to Fineout-Overholt, et al. [38], a clear search question is essential as it determines the path the researcher needs to follow in order to achieve the aim and objectives of the study. The development of search questions helps the researcher to keep in mind a clear understanding of the purpose of the search. Answering the search question(s) leads to successful completion of the search and achievement of the purpose of the search [39]. For this purpose, a search question was developed using the PICO framework. Although there are other search concept tools such as SPIDER,

SPICE, ECLIPSE, MIP, CLIP, CMO and CIMO, they were found to be not as relevant to the nature of this study as PICO. According to Facchiano, et al. [40], the PICO framework is an important tool for formulating a search question, and Brettle, et al. [41] assert that the specific clues of the search question highlighted by the PICO framework simplify the process. Moreover, breaking down the search question helps in developing the inclusion and exclusion criteria before initiating the search. The PICO framework consists of the following four components:

P - Problem/population under consideration

I - Intervention under consideration

C - Comparison of intervention

O - Outcome under consideration

Using the PICO framework, the search question was developed in the following manner:

- Population of the search was identified as first-year nursing students. The problem of the search is related to the need for improvement of resuscitation skills in these students. An important characteristic of the population is the need to develop their resuscitation skills.
- The plan was to analyse whether simulation training of neonatal resuscitation techniques helps to improve the resuscitation skills of first-year nursing students.
- Comparison includes secondary plans of intervention, and thus methods other than simulation of neonatal resuscitation techniques were considered. The objective of each of the methods was to help the first-year nursing students improve their resuscitation skills.
- The outcome of this measurement is limited to the improvement of resuscitation skills among first-year nursing students through simulation training.

The above PICO aspects are represented in the (Table 1) below.

Population (P)	Intervention (I)	Comparison (C)	Outcome (O)
First year or undergraduate nursing students	Low-fidelity or high-fidelity simulation training for improving resuscitation skills	Other instructional methods for improving resuscitation skills	Enhancement of resuscitation skills such as airway management or intubation

Table 1: PICO Search Terms.

Based on the above aspects of the PICO framework, the following question was framed for guiding the search process:

Does simulation training of neonatal resuscitation techniques improve resuscitation skills among first-year nursing students?

Keywords

Initially, an analysis of all relevant synonyms of specific keywords that define the three components of the PICO, namely population, intervention and outcome was done to develop the complete word list, which helped to identify relevant articles. It is important that the keywords within the searches are both precise and sensitive in order to provide effective results. The precision will impact the amount of appropriate literature recovered, whilst the sensitivity will impact whether all the pertinent data is found. The keywords included terms like first year nursing students, neonatal resuscitation simulation, and improvement of nursing skills, undergraduate nurses, low fidelity simulation, high fidelity simulation and neonatal resuscitation skills.

Databases Searched

According to Gerrish, et al. [42], identifying appropriate sources of information is a key element of the search process. Databases contain much published research which is available for review by subscribers. Fineout-Overholt, et al. [38] asserted that the database functions as a guide to help researchers obtain the required published articles with the help of keywords and filters. The purpose of accessing a database is to retrieve necessary secondary data that is reliable and relevant for answering the search question of the study [38]. Moreover, Khan, et al. [43] recommends searching several different databases to minimise bias. The electronic databases searched were MEDLINE and CINAHL. MEDLINE contains medical literature, published in medical, nursing, and health journals [44]. An important aspect of MEDLINE is that registration is not required and searches are free. In addition, the site provides a number of links to full articles On the other hand, CINAHL encompasses all of the journals that are related to nursing and health [45]. The features of CINAHL are easy to use and help in quick retrieval of the required information. Based on the PICO terms, the two databases (Table 2) yielded the following results.

	Population	Intervention	Outcome
CINAHL	14,358	1,491	209,106
MEDLINE	52,090	8,823	1,233,742

Table 2: Database Search Results.

Combining the Searches

Combining searches requires different tools that can help the researcher to narrow, broaden or modify the search. Boolean and truncation operators were adapted in order to combine searches. Boolean operators are an effective and logical tool to ensure focused and useful results [46]. Boolean is mostly used to narrow or broaden a search. Boolean words like 'or' and 'and' helped to broaden and narrow the search, respectively. These Boolean operators helped to merge or eliminate keywords in a search. AND was utilised to locate studies that contained two or more of the stated phrases, whereas the OR operator located information containing any of the searched expressions [46]. Craig, et al. [47] assert that the use of these operators can assist in increasing the output of searches by producing more data from fewer examinations. Truncation, on the other hand, was used to search the databases for related words. For example, truncation was found as a very effective adaptation when the word 'Nurs' and 'nurse' were used, which helped in gathering data related to words like 'nurses' and 'nursing'.

Inclusion and Exclusion Criteria

The basis of selecting relevant papers for a study depends on inclusion and exclusion criteria. Bhandari, et al. [48] assert that the articles to be included as a source of information in a review must satisfy the range of inclusion parameters, whereas those to be excluded from the list of articles should satisfy the exclusion criteria. (Table 3) below lists the inclusion and exclusion criteria which helped to select the papers to be reviewed.

Inclusion Criteria	Exclusion Criteria
Published in English to limit the time of translation	Published in other languages
Studies that advocate simulation practice for nursing students	Any study advocating simulation practice for healthcare professionals
Search papers published after 2009 since relevance would lie in recently published papers and searches	Search papers that are too old to be relevant for current healthcare practice

Table 3: Inclusion and exclusion criteria for selecting papers.

The above-mentioned inclusion and exclusion criteria are based on the purpose of the search, which aims on answer the developed search question:

Does simulation of neonatal resuscitation techniques improve resuscitation skills among first-year nursing students?

Search Process and Outcome

The search was repeated in each database as per the developed parameters of search and the inclusion/exclusion criteria. Moher, et al. [49] use a 'Preferred Reporting Items for Systematic Review and Meta-Analyses' (PRISMA) flow chart to show the inclusion and exclusion processes (Figure 1). After successful completion of the search in each database, the total of articles found by using keys words was 187. Exclusion of irrelevant articles reduced the total count by 130; excluded on the basis of title: 30 articles; included on the basis of title: 20 articles; excluded on the basis of abstract: 7 articles.

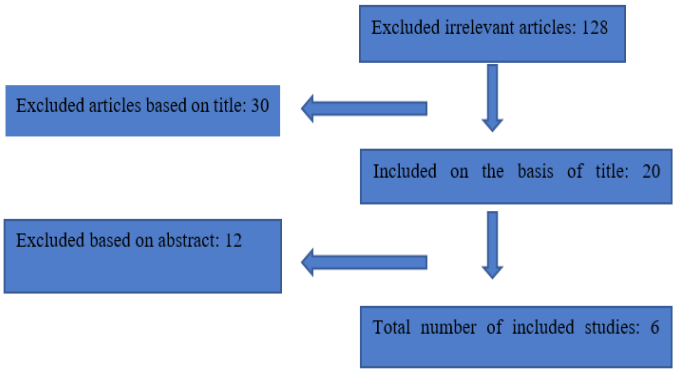

Figure 1: Overview of Literature Search.

As shown in (Figure 1) above, six articles were finally chosen for the review. The search question and the inclusion/exclusion criterion were not modified during the process. Brettle, et al. [41] suggest that the most appropriate information can be obtained by shifting the search from title and abstract to full text. The same criteria were employed to retrieve the most appropriate information to enable answering the search question. The six studies that were finally selected in this review are, a systematic review by Rakshasbhuvankar, et al. [50], a case study by Mills, et al. [51], a quasi-experimental study by Mohammed, et al. [52], two randomised studies [53,54] and a pre-test post-test randomised control study [55]. All of the above studies are relevant as they fulfil all the guidelines prescribed in the inclusion criteria. Each study is recent, being published after 2009, which means that the information is up to date. Furthermore, each piece of research concerns either the improvement of nursing students' skills, simulation training for resuscitation, or neonatal resuscitation techniques.

Conclusion

This chapter started with an overview of the systematic review and its purpose. Following this, the key points of the search process were discussed. First of all, the systematic search strategy, which focuses on the collection of information from databases of publications relevant to the research topic. Secondly, the formulation of the search question, which is derived from the aim and objectives of the research, as well as the development of the research question which asks whether nursing students can improve their resuscitation skills through simulation training of neonatal resuscitation techniques. After that, the PICO framework

was adopted to simplify and manage the search process. Specific tools such as Boolean and truncation operators were used in combining search terms. Finally, the inclusion and exclusion criteria were defined, which was in line with the search question. Defining these criteria helped in selecting six out of 180 articles that were initially found in the databases.

Findings

Introduction

Based on the search methodology discussed in the previous section, six research articles related to simulation training of neonatal resuscitation in nursing were selected. These studies included one systematic review [50], a case study [51], one quasi-experimental study [52], one randomised pretest-posttest control group study [55] and two randomized control trials [53,54]. A summary of all the studies is presented in tabular format along with the tool that was used for assessing the methodological quality see appendices A, B, C. Each of the studies was critically evaluated using the checklist in the Critical Appraisal Skills Programme assessment tool CASP [56]. Subsequently, a discussion of the research design and the overall quality of the six papers is presented at the end of this chapter.

Methodological Quality of the Included Studies

Booth [57] comments that it is vital to determine the reliability as well as the relevance of a particular context using a critical appraisal method. In this review, the Critical Appraisal Skills Programme [56] was used to evaluate the chosen studies. The CASP checklist tool contains eleven questions (See Appendices A, B and C), with which to assess the quality as well as strengths and limitations of a piece of research. These questions simplify the assessment procedure for appraising studies and help to identify their trustworthiness, effectiveness, reliability, as well as significance to practice, by evaluating the research design, sample, data collection and analysis, ethical approval and results based on the research question.

Critical Appraisal of the Included Studies

This section will discuss the critical appraisal of the included studies. All the studies focussed on the enhancement of resuscitation skills as a result of simulation training. The objective of the main intervention used in each of the six studies was to influence the understanding and perception of the participants with respect to enhanced resuscitation skills using simulation training. Out of the five primary research studies [51-55] reviewed, three [51,52,54] had nursing students as participants, which is significant with respect to the objectives of this review. The findings of the remaining three studies [50,53,55] are also important for this study as they all involve resuscitation, which increases the generalisability of this study's findings. Kothari [58] asserts that it is essential to select the right kind and number of participants in research studies, which depends on the sample design as well as the research methodology and technique. In quantitative studies, the objective of sampling is to collect reliable and valid data from the sample population, who are representative of the actual population [59]. Moreover, Parahoo, [60] also emphasises the need to appraise the size and characteristic of all eligible participants in any study that requires sampling. Thus, sampling and sample population significantly influence the generalisability of a study's findings, which refers to the extent to which the results are applicable to situations other than that in which they were actually examined. Additionally, the generalisability of a study's findings is based on the capability of the researcher to differentiate between relevant and irrelevant aspects of the study and then conclude regarding pertinent aspects [61].

Critical evaluation of Rakshabhuvankar, et al. [50] systematic review (Appendix A) revealed that even though not all important outcomes, such as clinical outcomes, were considered, the obtained outcomes are significant with respect to this review's objectives and can be trusted. Critical assessment of the quasi-experimental research study by Mohammed, et al. [52] (Appendix B) revealed that the results are valid for the targeted population (First-year nursing students) and conform with other relevant evidence related to the subject, which makes the results reliable. A full critical evaluation of the remaining four studies [51,53-55] undertaken using the relevant CASP checklist (Appendix C) revealed that the results of these studies are equally reliable and significant for the nursing population.

Overall Quality

Typically, a systematic review should include the full assessment of the quality of the included studies by employing well-defined, reproducible strategies that facilitate appraisal of the research methodologies and different characteristics of the study [62]. Each of the appraised six papers varied in the methodological approaches. There are a range of techniques used to assess methodological quality of the included studies in a systematic review. For example, Haywood, et al. [63] deemed the kind and number of tests performed as significant, whereas Alla, et al. [64] employed criteria developed for quality evaluation of trials. Marinus, et al. [65] reports that the aptness of the sample size and analysis is significant, whereas Wind, et al. [66] suggest that the aim, evaluation technique, population, analysis method and presentation of the results are crucial aspects for evaluating a study. In this review, once the papers had been appraised, the overall quality of evidence was assessed using GRADE as a framework [67]. GRADE assesses outcomes such as sample size, homogeneity of results, and how bias was managed (e.g. management of bias) (See Appendix D). Dijkers, [68] suggests that once graded, papers could be upgraded or downgraded according to the specific criteria as follows. (Upgrading) Large effect size, dose-response gradient, and all plausible confounding would reduce a demonstrated effect

and all possible confounding would suggest a spurious effect when the actual results show no effect. (Downgrading) Serious risk of bias, Serious inconsistence between studies, Serious indirectness, Serious imprecision and Likely publication bias the critical outcome relevant for this review's objective was the advantage of simulation training with respect to resuscitation skills, especially neonatal resuscitation for participants. All the studies focused on enhancement of various aspects like skill, performance, confidence and satisfaction related to resuscitation skills. Finally, based on the GRADE and Dijkers, [68], the quality of evidence was rated using the definitions of 'High', 'Moderate', 'Low' and 'Very low' as seen in (Table 4) below.

Article Title, Author And Reference	GRADE [68] Quality Score
Rakshasbhuvankar, et al. [50].	Low
Mohammed, et al. [52].	Moderate
Mills, et al. [52].	Moderate
Curran, et al. [55].	High
Lee, et al. [53].	High
Nimbalkar, et al. [54].	High

Table 4: Quality of the Included Studies.

As seen in (Table 4), all of the studies varied in quality range from low to high. Studies were downgraded if they had small sample size (less than 100), were non-blinded, or had bias or implied indirectness. For instance, the study by Rakshasbhuvankar, et al. [50] was downgraded by one point for inconsistency as there existed considerable differences in the results compared to the rest of the studies and it gave mixed conclusions [68]. This study was, therefore, not homogenous, which according to Higgins, et al. [69], indicates a poor-quality study that might affect the generalisability of the findings. On the other hand, the study by Nimbalkar, et al. [54] was upgraded by one point as it took care to balance the confounding factors that could have influenced the results. As Attia, [70] suggests, management of confounders is significant in ensuring a high quality robust results. As expected, all the RCTs proved to be of high quality for the critical outcome reviewed. As the papers were not homogenous, pooling the results was not possible [71].

Data Extraction

Khan, et al. [43] defines data extraction as the process of gathering relevant data from the articles. They further suggest that data extraction must contain characteristics, outcomes and results and references. Khan, et al. [43] argue that extraction could be personal and subject to bias and error.

Article	Intervention	Outcome	Bias control	Findings
Rakshasbhuvankar, et al. [50].	There was no intervention as this was a systematic review.	There is major impact of simulation training related to resuscitation on enhancing clinical results.	There was no publication bias for selecting the articles.	Adequate comparison of results with other studies. The included studies had limited sample size and used various designs.
Mohammed, et al. [52].	Simulation training related to various neonatal cardiopulmonary resuscitation scenarios was provided to the intervention group (35 nurses and 25 intern nurses) over a period of two months. The entire process was divided into various phases, namely assessment, preparation, implementation, post care and documentation.	Simulation training enhances the confidence, satisfaction and skills of intern nursing students and nurses related to neonatal resuscitation.	There was no selection bias.	Data analysis method well-explained. Adequate comparison of results with other studies. It was difficult to conduct the sessions during working hours of nurses and intern nurses. Moreover, it was difficult to ambulate the Sim-baby to place it under radiant warmer due to the presence of its connected line.
Mills, et al. [51].	Simulation training using standardised patients was given to 47 first year of nursing students.	High-fidelity simulation training help in development of clinical skills of first year nursing students.	There was no selection bias.	Consent was obtained from only five out of the 47 participants. Moreover, there was no control group for comparison of results as a result of simulation training. Previous year students who did not get an opportunity to practice on high-fidelity manikins could have been used as control group.

Curran, et al. [55].	Experimental group was exposed to ANAKIN and control group was shown a training video.	Computerised simulator training is equally effective as video for retaining resuscitation skills of medical students. There was high level of satisfaction amongst students who underwent computerised simulation training.	There was no selection bias as the students were randomly assigned to the two groups.	Generalisability of findings are limited due to John Henry effect and testing sensitisation effect. Adequate comparison of results with other studies.
Lee, et al. [53].	Simulation training was provided using high-fidelity mannequins.	Simulation based educational intervention can significantly improve the performance of students regarding the crucial initial steps in neonatal resuscitation.	There was no selection bias as participation was completely voluntary. Software was used to assign students to both groups.	Small sample size is the biggest limitation of this study. Moreover, it was conducted at only one residency program. Two subjects, who were initially included in the intervention group but could not participate, were included in control group due to the small sample size.
Nimbalkar, et al. [54].	The intervention group were trained using SimNewB simulator, whereas the control group was trained using Resusci Baby Basic Simulator. Both groups underwent training for 3 days and provided same lectures.	There was significant improvement skills between the two groups	There was no selection bias as all 101 students were included as participants. Software was used to randomly allocate students to the two groups.	The high confidence expressed by the students does not necessarily signify clinical proficiency. Feedback was taken after three months, which may have resulted in recall bias. Considerable sample size was used to collect data.

Table 5: Data extraction.

Included Studies

As discussed in the methodology section, a systematic review comprises of identification, integration and evaluation of all the available qualitative and/or quantitative literature related to the research subject for finding a relevant answer to a focused research question [31]. A systematic review helps in reducing the implicit bias of the researcher by having well-defined search strategies [62] and helps focus on the validity, impact, causality and evidence as compared to traditional literature reviews by examining the characteristics and quality of relevant studies [62]. The heterogeneity of the methodology used in the studies leads us to discuss the papers individually in the next section.

Systematic Review

Benefits of Simulation Based Training for Neonatal Resuscitation Education: A Systematic Review [50]

The study by Rakshabhuvankar, et al. [50] is a systematic review conducted with the help of the Cochrane technique, which involves registering the review with Cochrane Collaboration in order to decrease chances of bias related to RCTs, update systematic reviews, decrease possibility of duplication of studies amongst the various groups and to be a part of comprehensive library of all systematic reviews within the area [62,72]. Various credible databases like Cochrane, PsycInfo, Embase and PubMed were searched using pertinent keywords and their thesaurus terminologies to extract relevant articles related to the research subject. Both observation studies and studies based on experimental designs like quasi-experimental studies and Randomised Controlled Trials (RCT) evaluating the importance of simulation training for neonatal resuscitation was included. According to Kinser, et al. [73], control group helps in clear identification and differentiation of the impact on pertinent variable as a result of the intervention. Hence, studies that did not have a control group were excluded. Finally, the study included four studies, out of which three were RCT and one was non-RCT. All the included studies assessed the impact of simulation training with respect to neonatal resuscitation. The included participants were residents, nursing staff and medical students. The outcomes were measured based on the participants' performance during simulation setting, confidence in controlling a resuscitation situation and the skills gained.

RCTs

This study includes three RCTs [53-55], which is significant as RCTs are considered the gold standard for clinical trials as they validate the authenticity of the objective by mediating any limitation of systematic review like bias [74]. Conventionally, acquisition of skill related to neonatal resuscitation has been traditionally promoted by means of low fidelity mannequins.

However, all the three RCTs examined the impact of simulation training on the neonatal resuscitation skills of participants by using high-fidelity simulation training. Unlike the systematic review by Rakshabhuvankar, et al. [50], which yielded mixed results, all the three RCT's gave a clear answer to their research question. The study by Nimbalkar, et al. [54] aimed to compare the retention and acquisition of neonatal resuscitation skills, especially technical and cognitive skills based on the usage of high-fidelity and low fidelity simulation training. The primary research study by Lee, et al. [53] aimed to compare the effectiveness of neonatal resuscitation training based on simulation intervention with the contemporary emergency course for students. The research study by Curran, et al. [55] focuses on understanding whether the efficacy of a computerized simulator technique (ANAKIN) used to enhance the skills and confidence levels is sustained or decreases once the preliminary training sessions are over. The three RCTs are compared with respect to their different characteristics in the following sections:

Randomisation Process

There were three studies that used RCTs, and hence the key aspects of an RCT will be discussed collectively. Parahoo, [60] asserts that an RCT should include robust randomisation processes. Conforming to this aspect, the researchers of the three RCTs ensured that there was no selection bias during selecting participants as well as during allocation of a participant to either the control or experimental group, which added to the strength of their findings. In contrast, the appraisal of the study by Rakshabhuvankar, et al. [50] and Mohammed, et al. [52] revealed that both these studies lacked the key element of randomisation, which probably weakened the quality of evidence provided. Nimbalkar, et al. [54] made use of WinPepi software operated by a statistician blinded to the study to divide 101 undergraduate nursing students into low fidelity and high fidelity groups. Blinding ensures that the final outcomes are not influenced by any confounding factors and that the measured results can be more confidently attributed to the employed intervention [75]. Lee, et al. [53] made use of block randomisation technique, which was done with the help of random-number generator software to divide 27 participants who were 2nd, 3rd and 4th year students into equal numbers depending on their training level. Curran, et al. [55] also ensured that the participants (60 students studying third year medicine) were assigned using block randomisation to the two groups. It is acknowledged by Lachin, et al. [76] that the block randomisation method helps to ensure equal sample size. Thus, both Lee, et al. [53] and Curran, et al. [55] employed block randomisation to facilitate enhanced control of the balance. Besides eliminating selection bias, randomisation helped to mediate the various kinds of confounding variables [77] and ensured no prior knowledge regarding allocation, which otherwise may have resulted in probable selection bias that may manipulate the final results [78].

Bias Management

As discussed in the previous section, randomisation ensured that there was no selection bias in selection of participants as well as division of participants into the two groups in all the three RCTs studies. However, blinding that aims to decrease chances of ascertainment and performance bias after the randomisation process [79] was followed in all the included RCTs, thereby resulting in other kinds of bias. In the study by Nimbalkar, et al. [54], non-blinding of the teachers who examined the students could have resulted in performance bias. Performance bias refers to disproportionate provision of treatment other than the treatment being evaluated [80]. Hence, this may have resulted in differential treatment of the groups by the evaluators resulting in biased estimation of the effect of intervention. On the other hand, to eliminate any kind of bias in the study by Lee, et al. [53] the evaluations were recorded and assessed by an independent team of two instructors from the NRP (Neonatal Resuscitation Program) who were knowingly kept blinded regarding the details of the research study. Hence, any chance of performance bias was eliminated in the study by Lee, et al. [53]. In Curran, et al. [55] RCT, the evaluator was connected through a network link to the manikin simulator and received data from the instrumented manikin on a personal computer that showed the user's performance. Thus, as the evaluator was blinded to the user and evaluation was based completely on the report generated through a connected computer, there was no chance of any kind of performance bias [81].

Interventions Used

An intervention can be considered as a set of strategies that aim to generate specific modifications amongst a group of individual's representative of a specific population [60]. As evident in the included RCTs, interventions can comprise of educational programmes or sessions. Nimbalkar, et al. [54] divided the participants into SimNewB or Resusci® Baby Basic for the duration of three days. SimNewB, designed by Laerdal and the American Academy of Pediatrics (AAP) and launched in 2009, is a high fidelity simulator that helps to train neonatal skills through two-way interaction and aims to fulfil the training conditions of the NRP. The training in the RCT of Nimbalkar, et al. [54] was provided by five accredited and experienced nursing tutors. Even though both groups received the same lectures, their training was conducted on different kinds of mannequins. This enabled the comparison of educational outcomes between high-fidelity and low-fidelity simulation training, based on which decisions can be taken regarding the feasibility of introducing high-fidelity simulation training in nursing education, especially in countries experiencing resource challenges. In the RCT by Lee, et al. [53], EM course was used for the control group comprising of 15 members. The experimental group comprising of 12 members underwent an educational intervention that included skills station, medical simulation as well as didactics regarding neonatal resuscitation.

The RCT by Curran, et al. [55] exposed the participants to the computerised ANAKIN system at four months and then eight months after being trained for neonatal resuscitation. ANAKIN comprises of a manikin simulator having a computer-linked evaluation programme as well as a video-conferencing system. The manikin provides clinical health feedback to trainees and may be remotely controlled through a network link by an examiner who can evaluate the performance of the user. An important aspect with respect to interventions used is that the difference in the educational techniques can be a significant confounding variable that could well have influenced the educational outcomes in each of the three studies [82]. Although all three RCTs used different interventions, their outcomes were related to the critical outcome outlined using the Grade approach, which upgraded the quality of evidence with respect to this review's objective. Overall, after assessing the three RCTs using GRADE, the quality of all the three RCTs was assessed to be high.

Generalisability of Results and Replicability of the Study

Assessment of generalisability is significant to comprehend the extent to which a study's outcomes are applicable to another situation similar to the original one in terms of people, place, time or other relevant social context [83]. All three RCTs studied the impact of simulation training using a sample population different to that of the current review objective (First-year nursing students). Nimbalkar, et al. [54] used final year medical students, Lee, et al. [53] used EM (Emergency medicine) residents and Curran, et al. [55] used 3rd year medical students as participants. In spite of having participants belonging to healthcare fields other than nursing, the results of these three studies are equally valid for this review and can be applied to nursing students. This is because all of the studies focussed specifically on enhancement of neonatal resuscitation skills with the help of simulation training, which constitutes an important part of the research objective. The only limitation observed with respect to generalisability of the results of Lee, et al. [53] and Curran, et al. [55] appears to be their modest sample size. Sample size does not pose an issue for Nimbalkar, et al. [54] study as it has a sample size of 101, which is considerable for these kinds of studies. Such an understanding of the sample size is important to interpret the relevance of the findings to reflective in the whole population [60]. All three studies have described the sampling technique, method of allocation, process of conducting the experiment as well as the method employed for data analysis in sufficient detail.

Case Study Design

'Putting it together': Unfolding Case Studies and High-Fidelity Simulation in the First- year of an Undergraduate Nursing Curriculum [51]

Case studies are thorough investigations of one individual or a small number of individuals, which the researchers attempt to analyse and understand aspects that are essential to the history, development, or circumstances of the sample [84]. This kind of research can help in simulation because it focuses on understanding why an individual think, behaves, or develops in a simulation experience [84]. The popularity and reliability of simulation as an effective teaching tool in nursing education has increased considerably. Mill, et al. [51] investigated the extent to which simulation training finds acceptance amongst students. The case study, published in the journal Nurse Education in Practice, evaluated the level of satisfaction amongst first-year undergraduate nursing students when using a high-fidelity simulated environment for teaching clinical skills. The case study was based on four to six hours of simulation sessions. This method was appropriate as it enabled the researcher to obtain a complete in-depth insight regarding the research problem and facilitated description, comprehension and explanation of the research problem related to enhancement in resuscitation skills in nursing students due to high-fidelity simulation training [85]. A total of 47 students in the first year of Bachelor of Nursing Science, two standardised patients and three academic personnel were included in the study in order to obtain feedback about simulation training from different perspectives. The study collected both qualitative and quantitative data. Validated Quantitative tools, namely the Simulation Design Scale, Student Satisfaction and Self-confidence in Learning and Education Practices Questionnaire, developed by Jeffries, et al. [86], and certified by the National League for Nursing, were used to collect feedback from students. A qualitative inquiry is often by individual words and actions, thus the most useful way to gather like these data is audio recording [60]. Qualitative interviews gave an insight into the learning experience of academics and students. The limitation of the study as well as that of the setting is discussed and required justifications are given. One of the key limitations of this study was the absence of control group, which could have been previous year students who did not get an opportunity to practice on high-fidelity manikins. According to Polit, et al. [84] the absence of reliable baseline data that could have been provided by a control group impacts the reliability of the study's findings.

Quasi -Experimental Study

The Effect of Simulation Training on Nurses and Intern Nursing Students' Skill, Confident and Satisfaction Regarding Neonatal Resuscitation [52]

This research article, based on neonatal statistics of Egypt and published in the Journal of Nursing and Health Science, aimed to evaluate the impact of simulation training on the satisfaction, confidence and skill of intern nursing students and nurses with respect to neonatal resuscitation by means of a quasi-experimental research design. This method was most appropriate for this study as this study involved both nurses and intern nurses as participants. It would not have been logical to randomly divide them into experimental and control groups as both of them have

different levels of experience and knowledge due to which random assignment of either of them to one group could significantly influence the final results [32]. The research involved interviewing 25 intern nursing students and 35 nurses working at the NICU of Benha University using a structured questionnaire that contained checklist related to neonatal resuscitation sourced from the American Heart Association [1]. A Satisfaction and Confidence Learning Scale was also used to assess the confidence level after simulation training [87]. The results showed a higher level of satisfaction and confidence in nurse's students immediately after training related to neonatal resuscitation. This study by Mohammed, et al. [52] shows that simulation training enhances the satisfaction, confidence and skills of intern nursing students and nurses with respect to neonatal resuscitation and strongly advocates the incorporation of simulation training into educational programmes for nursing students.

Summary

This chapter has included the result of the identified study based on the methodological quality assessment for included studies. The six research studies included in this review supported the inclusion of simulation training in nursing education to enhance the skills, confidence and satisfaction of nurses.

Discussion

This chapter reviews and compares the existing research on simulation in nursing education. According to McCallum, [88] clinical skills development is a crucial aspect of nursing education, and, as Peteani, [89] points out, simulation training is one way of promoting this, since it offers nursing students the valuable opportunity to learn practical skills in a secure setting. In addition, simulation sessions also help to develop critical thinking and problem-solving skills. In reviewing the literature, it became apparent that improved self-confidence and greater satisfaction with the training courses were two major outcomes of using simulation in nursing education. These themes are explored in more detail below.

Improved Self-Confidence

The first major theme emerging from the literature on simulation in nursing education was improved self-confidence in clinical skills and competence. Self-confidence to be a separate skill that can be trained by continued practice and which empowers the learner to face challenges and solve problems.

Rakshabhuvankar, et al. [50] and Mohammed, et al. [52] have demonstrated that simulation training promotes the self-confidence, skills performance and the overall satisfaction of nursing students in the particular context of neonatal resuscitation education. This is significant, because, according to Goldenberg, et al. [90], self-confidence plays an important role in how students perceive the success of their clinical practice, and it influences their ability to fulfil their responsibilities once they begin working with patients. Similarly, Jhuma, et al. [91] showed that the skills score of nursing students increased by almost 84% after simulation training. Weaver, [92] and Lambton, et al. [93] also observe that students are significantly more self-confident as a result of simulation practice, which reflects the effectiveness of this safe training environment. These findings are further confirmed by El Sayed, et al. [94], who report that nursing students showed a significant increase (54% from zero) in confidence levels immediately after the simulation training. Moreover, Maurya, [95] asserts that regular feedback provided to nurses during simulation training helps in further developing their self-confidence.

Studies by Curran, et al. [55] and Mills, et al. [51], located in this review, suggest that the use of standardised patients and simulation-based learning are effective teaching techniques for nursing students. According to Mills, et al. [51], self-confidence is improved through simulation, which, in their research, was often practised with standardised patients. This provides a much more interactive learning environment for students than their initial learning experiences with manikins, and enables them to transition safely towards practising their skills with real patients. The enhanced learning which occurs during experiential training was conceptualised in Kolb, [96] experiential learning theory, which proposes that learning takes place over the four stages of direct experience, reflective observation, abstract conceptualisation and further experimentation. The use of standardised patients can help nursing students to enhance their communication skills, since learning with manikins by-passes the human elements of empathy and communication which are present in real-life situations. This finding is endorsed by Bokken, et al. [97] and McGovern, et al. [98] who confirm that teaching sessions with standardised patients provides a secure clinical setting in which confidence and communication skills are enhanced. This aspect is of course highly relevant to future real-life interaction with patients.

Other researchers have recommended the use of high-fidelity manikins [99-101], since this is a valuable way of teaching skills involving more invasive methods like the nasal intubation and IV cannulation. Moreover, Zull, [102] believes that this kind of high-fidelity simulation creates greater neuronal connections in the learner's brain due to the active participation of the motor cortex, as a result of which there is an increase in knowledge level and better skills performance. Peteani, [89] believes that greater knowledge and improved performance both lead to higher self-confidence in students, and this is especially important for first-year students, who have limited opportunities to practise with real patients. Simulation training is often the best way of familiarising students with new skills and techniques in a controlled, low stress, but very practical environment. Simulation training can be looked at in terms of Bloom's three domains [103]. In the cognitive domain, it helps students to analyse and understand

knowledge relevant to neonatal resuscitation. In the affective domain, simulation can provide students with various scenarios of neonatal resuscitation, and in the psychomotor domain, they are able to develop the essential skills and techniques for neonatal resuscitation. However, it is worth noting that simulation training is not a true substitute for real-life patient care. Each situation with a real patient presents its own challenges for students and qualified nurses alike. Furthermore, simulators are expensive and require high maintenance.

The study by Curran, et al. [55] have demonstrated a significant rise in student self-confidence after training with the ANAKIN system, which combines an instrumented manikin simulator, computer-based assessment and high-bandwidth videoconferencing. Curran, et al. [55] also found that students were much more confident in performing neonatal resuscitation techniques after being taught using the ANAKIN system. Similar findings were reported by Bokken, et al. [96] and McGovern, et al. [97], who assert that ANAKIN provides a secure clinical setting in which confidence and communication skills are enhanced. These qualities and abilities are essential to newly-qualified nurses as they begin to interact with patients in real-life situations. According to the theory of self-confidence, individuals who are more self-confident are more likely to be able to overcome challenges and to deal intelligently with failure [104]. A number of other studies have shown that simulation training in nursing education results in greater self-confidence and satisfaction; these two outcomes are closely linked [105,106].

Enhanced Satisfaction

The second major theme emerging from the literature on simulation in nursing education was enhanced satisfaction with training courses. Satisfaction can be defined as a state of mind that results when goals are achieved, and assessing levels of student satisfaction can be very useful when developing effective educational programmes [107]. According to Kim, et al. [108], satisfaction has a generally positive effect on the intention to learn. Jeffries, et al. [85] used the Jeffries model to measure student satisfaction and showed that those participants who were taught using simulation techniques developed better critical thinking and solving problem skills. The Jeffries model is a simulation Design Scale which can measure the level of satisfaction and self-confidence in learning and education practices [86].

In the same way, research by Mohammed, et al. [52] using randomised control trials found that nursing student satisfaction increased immediately after simulation training. Similar results have also been reported by Agha, et al. [109] and Roh, et al. [110], who noticed higher satisfaction and confidence levels as a result of simulation training, as well as a positive correlation between the skills, satisfaction and confidence of nursing students. Amin, et al. [111] reasoned that since simulation training enhances participants' perception of their skills, it should result in an increase in their overall confidence. In fact, students who were assessed after using the ANAKIN system expressed higher satisfaction with the use of technology in their education, and, as Gordon, et al. [112] suggest, this higher satisfaction level may be due to learners being able to practice their skills without presenting risk to real patients. Additionally, students considered ANAKIN to be a creative learning process which facilitated better understanding of the intricacies involved in neonatal resuscitation, and which could help them deal better with emergencies in real practice. According to Nayak, [113], using a small sample is tempting, but may well be a waste of time and money as the results are likely to be inconclusive. Researchers tend to choose a small sample arbitrarily based on convenience, available resources and time limitations; however, the results will not be sufficiently generalisable as to be of any practical use [113].

The pedagogic approach to satisfaction comes from the motivational theory of Keller [114]. Satisfaction occurs when the learner feels that the skills learned in simulation training are useful and beneficial to future practice in real settings. According to Chang, et al. [115], student satisfaction is an important component of skills acquisition. Students are considered to be satisfied if they feel that the lesson has met their needs and expectations. Satisfaction can motivate students to put more effort into learning, increase positive attitudes towards lessons, and increase the likelihood of further course attendance in future.

Summary

Although a number of studies document the effect of simulation training in resuscitation, very few focus particularly on neonatal resuscitation. The six reviewed research articles are supportive of simulation training in general nursing education. An analysis of these articles concludes that simulation training increases confidence, competence and satisfaction, and has a positive impact on the resuscitation skills of first year nursing students.

Conclusion and Recommendations

Conclusion

The aim of this review was to identify whether first-year nursing students can improve their neonatal resuscitation skills by the use of simulation in training. Undoubtedly, effective neonatal resuscitation can help to prevent a significant number of neonatal deaths [53], and in theory, practical sessions using simulation techniques may prepare students to face the challenges of working with real patients. The existing research suggests that simulation is an effective tool in nursing education. It has been found to enhance behavioural and communication skills and allows students to perfect clinical skills that are crucial to successful practice. Out of the reviewed research articles, six support the inclusion of simulation

training in the curriculum for nursing students, since this technique can lead to better practical skills, more self-confidence and greater satisfaction with education. However, simulation training calls for huge financial investment and therefore it is essential that new methods are researched to make it more cost effective for nursing institutions. The review provides evidence for the health education policy-makers that simulation training is a valuable method of increasing the self-confidence and practical skills of nursing students learning neonatal resuscitation techniques. In the long term, it is expected that using simulation in nursing education will help to reduce the mortality rate among neonatals.

Recommendations for Education

Based on the reviewed studies, the following recommendations have been developed for policy and decision makers in nursing education.

• Nursing students who are in close contact with new-borns should be provided with adequate simulated training on a regular basis by creating a schedule that suits everyone.

Simulated training sessions should include assessment and feedback on performance to reinforce the skills acquired from training.

• Classroom resources should be planned efficiently to incorporate simulation training in a cost-effective manner.

• A high level of proficiency in neonatal resuscitation is significant for improving outcomes, and therefore training workshops that include innovative training techniques should be arranged [116].

Recommendation of Methodology

The use of technology is highly recommended in nursing training to help prepare students to deal with a wide variety of situations. Computerised simulation training will give a more realistic and thorough real-life experience of neonatal resuscitation. The use of systems like ANAKIN can help in skills and evaluation training and is a more cost-efficient method as compared to direct methods, especially when training is to be provided in remote areas where the rate of neonatal death is high [56]. Manikin training also offers students a valuable opportunity to practice neonatal resuscitation skills on their own, particularly in rural areas. Feedback regarding resuscitation performance can be provided by instructors located in remote areas [56]. Once the students have begun to learn by practicing with manikins, similar clinical settings should be provided using high-fidelity manikins or standardised patients. This provides the opportunity to practice on real patients in a cost-effective manner and further enhances students' clinical and communication skills.

Recommendations for Future Research

The following suggestion is formulated as a SMART goal, i.e. specific, measurable, achievable, realistic, and time-limited [117]. Conducting further research on the effects of using simulations in neonatal resuscitation training for first-year nursing students in Saudi Arabia would address a research gap as there is little or no information about this specific area. The effects of this type of educational resource should be measured by assessing self-confidence, satisfaction, and skills after a number of controlled sessions. Future research should include a larger sample of students from a number of different training facilities in order to be able to generalise the findings to wider application. More robust research should be designed for future research in order to optimally measure the impact of simulation.

References

1. American Heart Association (2015) Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Texas: American Heart Association.
2. Rovamo LM, Mattila MM, Andersson S, Rosenberg PH (2013) Testing of midwife neonatal resuscitation skills with a simulator manikin in a low□risk delivery unit, Pediatrics International 55: 465-471.
3. Fountain RA, Alfred D (2009) Student satisfaction with high□fidelity simulation: Does it correlate with learning styles? Nursing Education Perspectives 30: 96-98.
4. Marshall JL, Spiby H, McCormick F (2015) Evaluating the 'focus on normal birth and reducing caesarean section rates rapid improvement programme': a mixed method study in England, Midwifery 31: 332-340.
5. Mannix P (2009) Neonatal resuscitation and the management of immediate neonatal problems, Best Practice in Labour and Delivery 273-284.
6. Weiner GM, Menghini K, Zaichkin J, Caid AE, Jacoby CJ, et al. (2011) Self-directed versus traditional classroom training for neonatal resuscitation, Pediatrics 127: 713-719.
7. Weick KE, Sutcliffe KM (2001) Managing the unexpected: assuring high performance in an age of complexity. San Francisco: John Wiley & Sons.
8. Issenberg B, Gordon MS, Gordon DL, Safford RE, Hart IR (2001) Simulation and new learning technologies, Medical Teacher 23: 16-23.
9. Seropian MA, Brown K, Gavilanes JS, Draggers B (2004) Simulation: not just a manikin, Journal of Nursing Education 43: 164-169.
10. Alinier G, Hunt B, Gordon R, Harwood C (2006) Effectiveness of intermediate□fidelity simulation training technology in undergraduate nursing education, Journal of Advanced Nursing 54: 359-369.
11. Beyea SC, Kobokovich LJ (2004) Human patient simulation: a teaching strategy, AORN Journal 80: 741-742.
12. Ward-Smith P (2008) The effect of simulation learning as a quality initiative, Urologic Nursing 28: 471-473.
13. Kohn LT, Corrigan JM, Donaldson MS (2000) To err is human: building a safer health system. A report of the Committee on Quality of Health Care in America, Institute of Medicine. Washington, DC: National Academy Press.

14. Deegan M, Terry L (2013) Student midwives' perceptions of real-time simulation: a qualitative phenomenological study, British Journal of Midwifery 21: 590-598.

15. Reynolds A, Ayres-de-Campos D, Pereira-Cavaleiro A, Ferreira-Bastos L (2010) Simulation for teaching normal delivery and shoulder dystocia to midwives in training, Education for Health 23: 405.

16. Tyer-Viola L, Zulu B, Maimbolwa M, Guarino A (2012) Evaluation of the use of simulation with student midwives in Zambia, International Journal of Nursing Education Scholarship 9.

17. Gaba DM (2011) The future vision of simulation in healthcare, Quality and Safety in Healthcare 13: i2-i10.

18. Cioffi J (2001) Clinical simulations: development and validation, Nurse Education Today 21: 477-486.

19. Kerr J, Bradley P (2010) Simulation in medical education, in Swanwick T (Edition) Understanding medical education. West Sussex: Wiley-Blackwell 164–180.

20. Garret DD, Kovecevic N, Mclntosh AR, Grady CL (2011) The Importance of Being Variable. Journal of Neuroscience 31: 4496-4503.

21. Dow A (2008) Clinical simulation: a new approach to midwifery education, British Journal of Midwifery 16: 94-98.

22. Osman H, Campbell OM, Nassar AH (2010) Using emergency obstetric drills in maternity units as a performance improvement tool, Obstetric Anaesthesia Digest 30: 39-40.

23. Broussard L (2008) Simulation□based learning: how simulators help nurses improve clinical skills and preserve, Nursing for Women's Health 12: 521-524.

24. Hayden J (2010) Use of simulation in nursing education: National survey results, Journal of Nursing Regulation 1: 52-57.

25. Meyer MN, Connors H, Hou Q, Gajewski B (2011) The effect of simulation on clinical performance: a junior nursing student clinical comparison study, Simulation in Healthcare 6: 269-277.

26. Guhde J (2011) Nursing students' perceptions of the effect on critical thinking, assessment and learner satisfaction in simple versus complex high-fidelity simulation scenarios, Journal of Nursing Education 50: 73-78.

27. Rochester S, Kelly M, Disler R, White H, Forber J, Matiuk S (2012) Providing simulation experiences for large cohorts of 1st year nursing students: evaluating quality and impact, Collegian 19: 117-124.

28. Sanford PG (2010) Simulation in nursing education: a review of the research, The Qualitative Report 15: 1006-1011.

29. Cummins J, Swain M (2014) Bilingualism in Education: Aspects of theory, research and practice. Routledge.

30. Swingler GH, Volmink J, Ioannidis JP (2003) Number of published systematic reviews and global burden of disease: database analysis, BMJ 327: 1083-1084.

31. Higgins JP (2008) S. Cochrane handbook for systematic reviews of interventions version 5.0. 2. The Cochrane Collaboration.

32. Lobiondo-Wood G, Haber J (2014) Nursing Research in Canada: Methods, critical appraisal, and utilization (3rd Edition). Toronto: Elsevier.

33. Aveyard H (2010) Doing a Literature Review in Health and Social Care: A Practical Guide. London: McGraw-Hill Education.

34. Forbes DA (2003) An example of the use of systematic reviews to answer an effectiveness question, Western Journal of Nursing Research 25: 179-192.

35. Grove S, Burns N (2010) The practice of nursing research: conduct, critique and utilization. St. Louis, Missouri: Elsevier Saunders.

36. Montori VM, Wilczynski NL, Morgan D, Haynes RB (2005) Optimal search strategies for retrieving systematic reviews from medline: an analytical survey BMJ 330: 68.

37. Richardson WJ, Greene CR, Malme CI, Thomson DH (1995) Marine Mammals and Noise.

38. Fineout-Overholt E, Berryman DR, Hofstetter S, Sollenberger J (2011) Finding relevant evidence to answer clinical questions. Evidence-based practice in nursing and healthcare: A guide to best practice [online].

39. Creswell JW (2013) Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Thousand Oaks: Sage Publications.

40. Facchiano L, Snyder CH (2012) Evidence□based practice for the busy nurse practitioner: Part one: Relevance to clinical practice and clinical inquiry process, Journal of the American Association of Nurse Practitioners 24: 579-586.

41. Brettle A, Grant MJ (2004) Finding the Evidence for Practice: A workbook for health professionals. Churchill Livingstone.

42. Gerrish K, Lacey A (2010) The Research Process in Nursing. John Wiley & Sons.

43. Khan KS, Ter-Riet G, Glanville J, Sowden AJ, Kleijnen J (2001) Undertaking systematic reviews of research on effectiveness: CRD's guidance for carrying out or commissioning reviews. University of York. York, UK: NHS Centre for Reviews and Dissemination.

44. Polit DF, Beck CT (2013) Generalization in quantitative and qualitative research: myths and strategies, International Journal of Nursing Studies 47: 1451-1458.

45. Beecroft CA, Booth A, Rees A (2010) Finding the Evidence. In: Gerrish K, Lacey A (Edition) The Research Process in Nursing. Oxford: Wiley Blackwell 65-78.

46. Sasala KM (2011) Boolean Searching. The Cleveland Law Library Association [Online].

47. Craig VJ, Smyth RL (2007) The Evidence-Based Practice Manual for Nurses. Edinburgh: Churchill Livingstone Elsevier.

48. Bhandari M, Devereaux PJ, Montori V, Cinà C, Tandan V, et al. (2004) Users' guide to the surgical literature: how to use a systematic literature review and meta-analysis, Canadian Journal of Surgery 47: 60.

49. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, et al. (2015) Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Systematic Reviews 4: 1.

50. Rakshabhuvankar AA, Patole SK (2014) Benefits of simulation based training for neonatal resuscitation education: a systematic review, Resuscitation 85: 1320-1323.

51. Mills J, West C, Langtree T, Usher K, Henry R, et al. (2014) Putting it together: unfolding case studies and high-fidelity simulation in the first-year of an undergraduate nursing curriculum, Nurse Education in Practice 14: 12-17.

52. Mohammed SA, Ahmed HM (2016) The effect of simulation training on nurses and intern nursing students' skill, confident and satisfaction regarding neonatal resuscitation. Journal of Nursing and Health Science 5: 17-27.

53. Lee MO, Brown LL, Bender J, Machan JT, Overly FL (2012) A medical simulation-based educational intervention for emergency medicine residents in neonatal resuscitation, Academic Emergency Medicine 19: 577-585.

54. Nimbalkar A, Patel D, Kungwani A, Phatak A, Vasa A, et al. (2015) Randomised control trial of high fidelity vs low fidelity simulation for training undergraduate students in neonatal resuscitation, BMC Research Notes 8: 636-642.

55. Curran VR, Aziz K, Young SO, Bessell C (2004) Evaluation of the effect of a computerised training simulator (ANAKIN) on retention of neonatal resuscitation skills. Teaching and Learning in Medicine 16: 157-164.

56. CASP (2002) Critical Appraisal Skills Programme: Making Sense of Evidence. Buckinghamshire: Milton Keynes Primary Care Trust.

57. Booth A (2011) Evidence□based practice: triumph of style over substance? Health Information and Libraries Journal 28: 237-241.

58. Kothari CR (2004) Research Methodology: Methods and Techniques. New Delhi: New Age International.

59. Babbie ER (2010) The Practice of Social Research (12th Edition) Belmont, CA: Wadsworth Cengage.

60. Parahoo K (2014) Nursing Research: Principles, Process and Issues. Palgrave Macmillan.

61. Rothman KJ, Greenland S, Lash TL (2008) Modern epidemiology (3rd Edition) Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

62. Mallet R, Hagen-Zanker J, Slater R, Duvendack M (2012) The benefits and challenges of using systematic reviews in international development research, Journal of Developmental Effectiveness 4: 445-455.

63. Haywood KL, Garratt AM, Fitzpatrick R (2006) Quality of life in older people: a structured review of self-assessed health instruments, Expert Review of Pharmacoeconomics and Outcomes Research 6: 181-194.

64. Alla S, Sullivan SJ, Hale L, McCrory P (2009) Self-report scales/checklists for the measurement of concussion symptoms: a systematic review, British Journal of Sports Medicine 43: i3-i12.

65. Marinus J, Ramaker C, Hilten JJ, Stiggelbout AM (2002) Health related quality of life in Parkinson's disease: a systematic review of disease specific instruments, Journal of Neurology, Neurosurgery and Psychiatry 72: 241-248.

66. Wind H, Gouttebarge V, Kuijer PPFM, Frings-Dresen MHW (2005) Assessment of functional capacity of the musculoskeletal system in the context of work, daily living, and sport: a systematic review, Journal of Occupational Rehabilitation 15: 253-272.

67. The Grade Working Group (2012) Grade: from evidence to recommendations – transparent and sensible [Online].

68. Dijkers M (2013) Introducing Grade: a systematic approach to rating evidence in systematic reviews and to guideline development, Knowledge Translation Update 1.

69. Higgins JP, Thompson SG, Deeks JJ, Altman DG (2003) Measuring inconsistency in meta-analyses. British Medical Journal 327: 557.

70. Attia AM (2005) Bias in RCTs: confounders, selection bias and allocation concealment. Middle East Fertility Society Journal 10: 258.

71. Petitti DB (2000) Meta-analysis, decision analysis, and cost-effectiveness analysis. Methods for quantitative synthesis in medicine. 2. Auflage. New York: Oxford University Press.

72. Higgins JP, Altman DG, Gotzsche PC, Juni P, Moher D, et al. (2011) The Cochrane collaboration's tool for assessing risk of bias in randomised trials, BMJ 343: d5928.

73. Kinser PA, Robins JL (2013) Control group design: enhancing rigor in research of mind-body therapies for depression, Evidence-based Complementary and Alternative Medicine 140467.

74. Chalmers TC, Smith H Jr, Blackburn B, Silverman B, Schroeder B, et al. (1981) A method for assessing the quality of a randomized control trial, Controlled Clinical Trials 2: 31-49.

75. Kim J, Shin W (2014) How to do random allocation (Randomisation). Clinics in Orthopaedic Surgery 6: 103-109.

76. Lachin JM, Matis JP, Wei LJ (1988) Randomizations in clinical trials, conclusions and recommendations, Controlled Clinical Trials 9: 365-374.

77. Suresh KP (2011) An overview of randomisation techniques: an unbiased assessment of outcome in clinical research, Journal of Human Reproductive Sciences 4: 8-11.

78. Schul KF, Grimes DA (2002) Allocation concealment in randomized trials: defending against deciphering, Lancet 359: 614–618.

79. Altman DG, Schulz KF (2001) Statistics notes: concealing treatment allocation in randomised trials, BMJ 323: 446-447.

80. Moher D, Pham B, Jones A, Cook DJ, Jadad AR, et al. (1998) Does quality of reports of randomised trials affect estimates of intervention efficacy reported in meta-analyses? Lancet 352: 609-613.

81. Fincher W, Shaw,J, Ramelet AS (2012) The effectiveness of a standardised preoperative preparation in reducing child and parent anxiety: a single□blind randomised controlled trial. Journal of Clinical Nursing 21: 946-955.

82. Cook DA (2012) If you teach them, they will learn: why medical education needs comparative effectiveness research, Advances in Health Sciences Education 17: 305-310.

83. Trochim WM (2005) Research Methods: The concise knowledge base. Cincinnati, Ohio: Atomic Dog Publishing.

84. Polit D, Beck C (2012) Essentials of nursing research. Ethics 23.

85. Baxter P, Jack S (2008) Qualitative case study methodology: study design and implementation for novice researchers, The Qualitative Report 13: 544-559.

86. Jeffries P, Rizzolo M (2006) Designing and implementing models for the innovative use of simulation to teach nursing care of ill adults and children: a national, multi-site, multi-method study. New York: National League for Nursing.

87. Yong-Shian GOH, Selvarajan S, Chng ML, Tan CS, Yobas P (2016) Using standardized patients in enhancing undergraduate students' learning experience in mental health nursing. Nurse education today 45: 167-172.

88. McCallum J (2007) The debate in favour of using simulation education in preregistration adult nursing, Nurse Education Today 27: 825-831.

89. Peteani LA (2004) Enhancing Clinical Practice and Education With High-fidelity Human Patient Simulators. Nurse Educator 29: 25-30.

90. Goldenberg D, Andrusyszyn MA, Iwasiw C (2005) The effect of classroom simulation on nursing students' self-efficacy related to health teaching, Journal of Nursing Education 44: 310-314.

91. Jhuma S, Vijayakanthi N, Sankar J (2011) Effect of a training module in cardiopulmonary resuscitation on the knowledge and skills of paediatric nursing personnel. Indian Journal of Emergency Pediatrics 3.

92. Weaver A (2011) High fidelity patient simulation in nursing education: an integrative review, Nursing Education Perspectives 32: 37-40.

93. Lambton J, Pauly S, Dudum T (2008) Simulation as a strategy to teach clinical paediatrics within a nursing curriculum, Clinical Simulation in Nursing 4: 79-87.

94. El Sayed FA, Soliman GE (2015) The changes in knowledge, confidence and skills accuracy of nursing students at a simulated based setting versus traditional during neonatal resuscitation, International Journal of Nursing Didactics 5: 11-22.

95. Maurya A (2015) Effectiveness of simulation teaching on neonatal resuscitation skill procedure among nursing students, International Journal of Science and Research (IJSR) 4: 2506-2511.

96. Kolb DR (1984) Experiential learning: experience as the source of learning and development. Upper Saddle River, NJ: Prentice Hall.

97. Bokken L, Rethan JJ, van-Heurn L, Duvivier R, Scherpbier A, et al. (2009) Students' views on the use of real patients and simulated patients in undergraduate medical education, Academic Medicine 84: 958-963.

98. McGovern MM, Johnston M, Brown K, Zinberg R, Cohen D (2006) Use of standardized patients in undergraduate medical genetics education, Teaching and Learning in Medicine 18: 203 - 207.

99. Wilson M, Shepherd C, Kelly C, Pitzner J (2005) Assessment of a low-fidelity human patient simulator for the acquisition of nursing skills, Nurse Education Today 25: 56-67.

100. Kelly M, Flanagan B (2010) Editorial: trends and developments in the use of health care simulation. Collegian: Journal of the Royal College of Nursing Australia 17: 101-102.

101. Yuan HB, Williams BA, Fang JB (2011) The contribution of high-fidelity simulation to nursing students' confidence and competence: a systematic review, International Nursing Review 59: 26-33.

102. Zull JE (2002) The art of Changing the Brain: Enriching the practice of teaching by exploring the biology of learning. Sterling, VA: Stylus.

103. Bloom BS (1956) Communicating Different and Higher across the Praxis of Bloom's Taxonomy While Shifting toward Health at Every Size (HAES). Health 7: 6.

104. Bandura A (1983) Self-efficacy determinants of anticipated fears and calamities, Journal of Personal Social Psychology 45: 464–469.

105. Smith SJ, Roehrs CJ (2009) High-fidelity simulation: factors correlated with nursing student satisfaction and self-confidence, Nursing Education Perspectives 30: 74-78.

106. Robinson-Smith G, Bradley PK, Meakim C (2009) Evaluating the use of standardised patients in undergraduate psychiatric nursing experiences, Clinical Simulation in Nursing 5: 203 -211.

107. Zarghami F, Hausafus CO (2002) Graduate student satisfaction with interactive televised courses based on the site of participation. Quarterly Review of Distance Education 3: 295-306.

108. Kim SC, Brown CE, Fields W, Stichler JF (2009) Evidence□based practice□focused interactive teaching strategy: a controlled study, Journal of Advanced Nursing 65: 1218-1227.

109. Agha S, Alhamrani AY, Khan MA (2015) Satisfaction of medical students with simulation based learning, Saudi Medical Journal 36: 731-736.

110. Roh YS, Lee WS, Chung HS, Park YM (2013) The effects of simulation-based resuscitation training on nurses' self-efficacy and satisfaction, Nurse Education Today 33: 123-128.

111. Amin HJ, Aziz K, Halamek L, Beran T (2013) Simulation-based learning combined with debriefing: trainers' satisfaction with a new approach to training the trainers to teach neonatal resuscitation, BMC Research Notes 6.

112. Gordon JA, Wilkerson WM, Shaffer DW, Armstrong EG (2001) Practicing medicine without risk: Students' and educators' responses to high-fidelity patient simulation, Academic Medicine 76: 469-472.

113. Nayak BK (2010) Understanding the relevance of sample size calculation. Indian Journal of Ophthalmology 58: 469.

114. Keller JM (2009) Motivational design for learning and performance: The ARCS model approach. Springer Science & Business Media.

115. Chang V, Fisher DL (2003) The validation and application of a new learning environment instrument for online learning in higher education. In MS Khine and DL Fisher (Editions), Technology-Rich Learning Environments A Future Perspective (pp. 1-20). Singapore: World Scientific Publishing Co. Pte. Ltd.

116. Lin Y, Cheng A (2015) The role of simulation in teaching pediatric resuscitation: current perspectives. Advances in Medical Education and Practice 6: 239-248.

117. Conzemius A, O'Neill J (2009) The Power of SMART goals: Using goals to improve student learning. Solution Tree Press.