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The Use of High-Fidelity Simulation (HFS) to Teach Clinical Skills to Undergraduate Nursing Students: A Systematic Review

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Abstract
Background: *Simulation has been identified as one of the best methods and incentives for education, and as a method, the nursing education incorporates this possibility through different levels or areas. Even though simulation has a long history in education, there have been modifications completedupon the approach or methodology due to technological innovations. Through modern technology, low and high fidelity simulations have been developed with their differences based on the extent to which one of the methods leads to closer and accurate imitations of patient situations. Hence, High-Fidelity Simulation (HFS)is increasing in progress within speciality sectors, such as nursing education, due to its perceived effectiveness in helping nursing students to acquire clinical skills and knowledge.*
Aim*: The review aimed to explore how HFS is effective in helping undergraduate student nurses to gain clinical skills (technicalskills).*
Method: *The current report is a systematic review, wheresystematic approach sampling was used to identify and screen the sources from selected databases, including MEDLINE, Cochrane, CINHAL, Academic Search Premier, Saudi Digital Library, Academic search premier, PubMed, and Ovid. The review selected 8 articles published between 2008 and 2018 and used a narrative analysis to compare and contrast what the current research states and identifiesto be the benefits of HFS in teaching clinical skills.*
Results:*Overall, 8 studies met the inclusion criteria for review, and the findings indicated that HFS is better than Low-Fidelity Simulation (LFS), and considerably better than traditional or conventional learning methods, which do not provide practice and simulated experiences for nurse students to experience technical areas, such as injections, cardiopulmonary resuscitation (CPR), drug administration.*
Conclusion: *All the findings from the studies reviewed show that HFS improves students' knowledge retention and clinical skills.*
Key words*: Simulation, High-Fidelity Simulation, Undergraduate Student Nurses, Clinical Skills.*

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I. Background

Conventionally, nursing learning regarding patient care has beenconducted during the practice of patient care, although this has created dangers and concerns over errors committed by student nurses that risk patients' health (Price et al., 2015). Concerns in regards to patient safety have led to renewed emphasis upon identifying solutions and approaches, in order to address risks and errors during patient care, as efforts have moved towards recognising how technology can address this (Day-Black, 2015). Innovations in technology are gaining ground in modern nursing teaching, and used in training methods to reduce patients' exposure to preventable human errors (Fiedler et al., 2014). Accordingly, Dunbar-Reid et al. (2011) reports that the future of healthcare education may be challenging, due to the need to be innovative; while generally, people have been resistant to the adoption of new teaching methods, such as simulation, and thus, remain with traditional theory-based classroom teaching.

One of the areas of innovation in nurse education is High-Fidelity Simulations (HFS), as an approach to teaching, whereby students are provided with a realistic imitation of reality nursing care practice (Dunbar-Reid et al., 2011). Accordingly, countries, including the UK, the USA and Australia have adopted it in education programmes (NMC, 2018; Bahner, Goldman, Way, Royall & Liu, 2014; Robertson & Davies, 2017). Various studies (Dunbar-Reid et al., 2011; Hall, 2015; Huiqin, et al., 2012) have explored simulation in education. Therefore, this study identifies these research works; their assessment of the usefulness or effectiveness of HFS in nursing practice; the emphasis they take regarding necessary improvements; and the best frameworksto implement HFS.

Despite minimal evidence being present in this area, it is evident that HFS is gaining increasing scholarly attention. For instance, Lindsey and Jenkins (2013) have argued that HFS supports students in developing clinical judgment by enhancing knowledge retention, as well as clinical decision making. According to Weaver (2011), HFS, involving realistic simulations of patients in clinical settings for training healthcare workers, has gained increasing importance within nursing education. Hence, the central challenge for nursing educational providers is to provide justification for investment into the required time and financial costs for training departments to implement HFS and integrate such technologies into curricula (Smith-Stoner, 2009). Subsequently, the best way to address this issue is to engage in scholarly exploration or research to consider whether HFS education or training improves nursing students' skills' development.

Based on the above consideration, the current research presents a systematic review to explore whether HFS improves skills development among undergraduate student nurses. The study anticipates that HFS provides an interactive and experiential learning environment, thereby improving undergraduate nursing students' overall knowledge retention, and therefore, enhances the development of clinical skills and knowledge. The results of this review could profoundly influence the nursing profession, asHFS, despite being a new area of technological development, presents prospects for students' skills' improvements; thus, is a necessary intervention in error reduction,and in enhancing quality and clinical care effectiveness.

1.1 Simulation

Various issues within nursing have led to renewed efforts toward identifying the best alternatives for improving student nurses' skills. Specifically, there is an issue with probable dangers occurring to patients when they are utilised in learning during their hospital stays (Lewis et al., 2012). Consequently, nursing education providers have directed their attention towards innovative or technology-based nursing educational approaches that decrease the exposure of patients to preventable errors (Lindsey & Jenkins, 2013). Smith-Stoner (2009) reports concerns regarding the lack of clinical experience in nursing education made available to student nurses as enabling individuals to apply learned theory in practice through practice hours. For example, in the USA and Australia, the number of practice hours is set at 1,000, while the UK allows 2,300 (Royal College of Nursing, 2018).

A challenge for nursing students is that high-dependency units may have low patient volumes; consequently, certain students remain without patients and gain no opportunitiesto practise essential skills (Mooring, 2016; Ebrahimi et al., 2016). In addition, the units may potentially be too busy, and students may not acquire the time to conceptualise and understand the essential concepts in critical care (Flott & Linden, 2016). Therefore, the situation implies that students are likely to lack hands-on experience with real-life or live patients that is required to become clinically successful/competent nurses (Norman, 2012). This crucial omission in patient experience in critical care and other units is a serious concern, as inappropriate care, for example in maternity units, jeopardises both the life of mothers and infants (Mooring, 2016). Moreover, the need for simulation in nursing education arises as all accrediting or licensing entities begin toutilise simulation to evaluatenurses' competences (Weaver, 2011). Therefore, there is a call for healthcare teaching institutions and organisations to invest in the development and use of simulation when training their novice practitioners as the best and most useful way to reduce medical errors (Sanko, 2017).

Errors in patient care are strong indications of technical and non-technical skills that are lacking among healthcare professionals or caregivers (Lewis et al. 2012). However, simulation-based learning has been proven to enhance both technical skills, such as performing injections; dressing and flushing nasogastric tubes; and non-technical skills,such as interpersonal communication; decision making;and leadership and teamwork; of which the overall outcomes are noted through improved behaviours of healthcare teams in various clinical contexts or settings (Sanko, 2017). Additionally, simulation-based learning enhances the development of self-efficacy, as well as improving the confidence of student nurses and specific nursing professionals regarding their clinical competencies and abilities (Norman, 2012). The effectiveness of different pedagogical approaches has been compared in particular to traditional classroom learning. For instance, Ebrahimi et al. (2016) reports from students who were assessed on imitation-based teaching, that critical thinking was improved.

Simulation-based learning also addresses students' issues and concerns, such as the challenges they experience when attending to critical care patients, of which some have raised worries about patients who experience discomfort when they are close to dying (Smith-Stoner, 2009). However, the role of a simulator is to help bridge the deficiencies in knowledge and capability of caring for dying patients; all aims at the acquisition of vital skills useful in facilitating meaningful death experiences. Smith-Stoner (2009) noted that, even though simulations have technical complexities, they broaden students' knowledge and experience.

1.2 High-Fidelity Simulation (HFS)

Historically, HFS was developed based on Thorndike's model of contextual and environmental aspects of learning and knowledge application(Munshi, Lababidi & Alyousef, (2015; Bultas et al., 2014). Therefore, in

this study, HFS is defined using the explanation by Bultas et al. (2014), which involves amalgamating a computerised full-body manikin that is automated to present a real functional response to actions by the simulator. However, the term 'fidelity' has a specific meaning, definedas the extent to which the instructor or training reproduces reality, and as either "low" or "high" based on the degree to which they express "real life". Therefore, fidelity measures a model's or simulation's realism. High fidelity, in this case, means a high level of realism, and also a real or simulated healthcare environment with the student nurse.

1.3 HFS and Enhanced/Improved Clinical Skills in Undergraduate Student Nurses

The role and usefulness of HFS in nursing education revolves around improving social and cognitive skills to complement the technical skills in nursing (Lewis et al., 2012).Accordingly, non-technical skills are essential in interaction and relationship development and critical thinking, such as: the ability to read;to comprehend situations; and to make decisions to aid in task execution (Lewis et al., 2012).The dynamic nature of healthcare compels practitioners to execute complex roles; hence, advanced critical thinking abilities are necessary. Developing critical thinking or improved clinical judgement enables professionals to positively influence patient outcomes when confronted with complex care management scenarios (Hall, 2015).

Lewis et al. (2012) state that HFS enhances clinical decision making by empowering students towards increased knowledge retention by reducing anxiety regarding clinical practice, alongside increasing confidence among student nurses and healthcare professionals;although this also presents the disadvantage of increasing anxiety among those who are not used to working in simulated environments. However, others suggest that modern healthcare management require students to become familiar with patient situations (Huiqin et al., 2012). Therefore, HFS technology helps the nursing faculties to produce accurate clinical scenarios to enable active education without threatening patient safety, as students review specific errors;thus, positive learning ensues from their mistakes (Richardson et al., 2014). Empowered learning occurs, as HFS provides broader learning areas, and allows students to extend their knowledge (Dunbar-Reid et al., 2011). Simulation promotes didactic learning, in which students' knowledge is enhanced and retention is prolonged in comparison to traditional lecture teaching (Huiqin et al., 2012). Therefore, HFS improves knowledge retention in technical and non-technical areas of nursing education (Gray et al., 2012; Hall, 2015; Dunbar-Reid et al., 2011).

1.4 Significance of the Review

The significance of this systematic review stems from providing evidence related to using HFS in teaching undergraduate students, which could result in devising improved programmes for healthcare training, along with updated evidence-based guidelines. In the Kingdom of Saudi Arabia (KSA), several studies have determined the importance of simulation on nursing students' competence (Zakari, Hamadi, Audi & Hamadi, 2017; Mahmoud, Althobaiti, Althobaiti, Althomali & Yossef, 2018). Hence, this study will extend and broaden the understanding of how simulation models, such as HFS can improve student competence in both technical areas in the KSA. Nonetheless, no previous systematic review exists regarding improving the clinical skills of this nursing student group by using HFS. The review is, therefore, important in offering usable evidence related to utilising HFS to improve clinical skills in undergraduate nurses. This should ultimately result in improved training programmes in nursing education.

1.5 Review Aim and Objectives

The review addresses the following question: what evidence is given by the literature in respect to using High Fidelity Simulation among undergraduate student nurses clinical skills? Based on this, the principle aim of the project is to perform and report a systematic review concerning the evidence regarding using HFS with undergraduate nursing students to teach clinical skills. Subsequently, the following objectives will be addressed by this review:

- To critically evaluate the use of HFS in teaching nursing undergraduates' clinical skills;
- To provide recommendations for nurses and other health care professionals and policy makers on the importance of using HFS to improve clinical skills.
- To suggest how the government in the KSA can formulate and implement HFS within nursing education as a major requirement.

1.6 Organisation of the Review

The review's background is established in Chapter OneandChapter Two, which discuss the quality of the methodological approaches for reviewing the selected articles. Chapter Three assesses and evaluates the relevance, as well as the extent to which the results are appropriate, while Chapter Fourprovides a detailed findings' discussion. For Chapter Five, the review is concluded with recommendations on how to implement HFS, suggestions for future research, and implications for practice.

II. Methodology

2.1 Introduction

This chapter describes and discusses the methods used for the review, before presenting its aims. It then presents the detail of the search strategies employed and the criteria which the studies were included or excluded from the review. Furthermore, this chapter details the process used to extract data and the approach used for analysis.

2.2 A Systematic Review

The study employs a systematic review (SR), defined as the overall synthesis and appraisal of primary research papers by using a defined, clear and rigorous methodology for the search strategy, as well as for the selection of the returned studies (Uman, 2011). Furthermore, a SRentails a comprehensive and detailed plan, alongside a search strategy developed prior to the search, in which the overall emphasis focuses on reducing bias by identifying, appraising and synthesising the relevant and applicable studies available for the specific topic (Khan et al., 2003). This design was used in the current study, as the SR always involves the summary of the results available from carefully defined and designed healthcare studies, and thus, presents the advantages of providing higher degrees of evidence of the effectiveness of healthcare interventions (Uman, 2011). From this, it enables for judgments and inferences to be made from the presented evidence, and equally informs recommendations for improvements in healthcare. However, the main challenge with this approach is that such reviews are often complicated, as they are based on available clinical trials, which require extensive quality appraisal to ascertain the measured outcomes' validity and reliability(Zeng et al., 2015).

2.3 Summary of Findings

Lewis and Clarke (2001) report that after evidence is categorised according to the hierarchy of evidence, a summary of the results is compiled, with the results often presented through tabulation or in other visual forms, for a systematic and user-friendly presentation. The results may be pooled numerically through meta-analysis, with the objective of decreased bias and more accurate decision-making (Sackett & Wennberg, 1997). However, according to Jadad and Enkin (2007), the homogeneity of quantitative data is challenging in most studies because most research on different topics are based on heterogeneous findings.

2.4 Significance of the Systematic Review

Various articles consider the aims to conduct a SR(Higgins, 2011; Gough, Oliver & Thomas, 2013;Aveyard & Sharp, 2013. It is reported that SRs are similar to traditional literature reviews, although they are constructed from a predefined question for research and performed following clearly-defined and transparent objectives,as well as through the use of systematic evaluation methods. SRs offers advantages, as theyenable the present state of knowledge to be identified and influence the direction of future research by highlighting areas where research gaps exist (Boland, Cherry & Dickson, 2014; Holly, Salmond & Saimbert, 2016). In particular, a suggestion has been made that systematic reviews should develop in a different direction from the model defined by Cochrane (global network of health professionals and researchers), which is most suitable in the assessment of evidence from Randomised Control Trials (RCTs): this move could lead to improved approaches to assess studies using qualitative and quantitative methods (Hemingway & Brereton, 2009). Moreover, although the Cochrane Database of Systematic Reviews (CDSR) considers quality of evidence from SRs, it does not consider healthcare settings and interventions, but assesses validity and reliability via wider evidence of good quality. Hence, any SR should be well-structured and comprehensive, due to their essential position in directing the regulations and practice of nursing (Fleming, Koletsi, Ioannidis & Pandis, 2016; Ten Ham-Baloyi & Jordan, 2016).

2.5 Advantages and Disadvantages of a Systematic Review

Table 1 below presents a summary of the advantages and disadvantages of systematic reviews.

Table 1: Advantages and Disadvantages of a Systematic Review

Advantages	Disadvantages
- Itseeks to address a specific question through the use of detailed and clear methods to identify the studies with the most relevance, and to conduct a critical appraisal of these (Olsson et al., 2014) - It aims to reduce bias and facilitate useful conclusions (MacGill, 2017). - It allows the author to develop their critical analysis skills (Olsson et al., 2014). - There is less need for ethical consents, as secondary sources are exclusively used (MacGill, 2017). - Itis especially useful to address clinical problems and produce novel hypotheses (Ganeshkumar & Gopalakrishnan, 2013).	- It requires a high level of complexity and significant completion time (Olsson et al., 2014). - Not all journals publish SRs (MacGill, 2017). - The findings of a systematic review often conflict with future experimental findings (Ganeshkumar & Gopalakrishnan, 2013).

-It forms beneficial reference material for researchers and healthcare professionals (MacGill, 2017). -It reduces the duration from the discovery of new findings and changes in practice or regulation (MacGill, 2017).	

2.6 Search Strategy

Daniel and Sam (2011) state that search strategiesare central to any SR, and they advise that the search process should be fully transparent, together with the thought process and criteria to include studies.Each stage in the review must be carefully designed and considered, according to Torgerson (2003), as this is essential for a rigorous methodological approach, and ultimately, evidence quality. The stages of the SR are presented in Figure 1:

Stages	Steps
1	Formulate the question
2	Establish a review protocol
3	Systematically search for relevant studies
4	Appraise the quality of the studies
5	Extract the data by utilising the data collection tool
6	Synthesis of the result

Figure 1: Systematic Review Steps

2.7 Formulation of the Question

A study ought to be guided by a researchable and realistic question(s), which can be answered; in the case of SR, which are imperative for the reviewer (Gerrish & Lacey, 2010). When undertaking a SR, frameworks or models are suggested to help develop review questions; for example, PICO and SPICE (Perry, Potter & Ostendorf, 2016; Davies, 2011). In this review, the PICO framework was chosen, as it helpedto divide the review into an easy framework to follow. The PICO acronym stands for population, intervention, comparison and outcome, which in essence helps to decide the specific key elements and components before beginning the review (Uman, 2011)(see Appendix 1).. Table 2 shows the PICO Framework that was used in this review:

Table 2: PICO Framework

Population	Student Nurse
Intervention	High-Fidelity Simulation
Comparison	None
Outcome	Improve the Clinical Skills

2.8 Search of the Literature

2.8.1 Search Process

The first search began with a "scoping search" of the databases, which entailed an abstract search of the identified terms without confining them to specific search outcomes (Aveyard, 2014). This identified whether there were studies on "HFS in nursing teaching", or whether studies had been conducted to ascertain how "HFS improves nurse student skills". However, an advanced search was also used, which confined the search to year, journal articles, peer-reviewed and full-text, through the "advanced search" function. Moreover, the advanced search was refined to search terms and this entailed using the tool, Boolean operators, "AND" and "OR" and truncation. The clinical librarian helped provide access to up-to-date sources via various databases, which covered numerous journals. Indeed, searching comprehensively with a set date range allowed current articles to be found, which made the review more reliable (Uman, 2011; Mallett et al., 2012). The first online searches were conducted to locate medical and nursing research relevant to the topic and performed via EBSCO and employed "OR" and "AND" Boolean operators. The databases utilised for the search are shown in Table 3, although this stage of the search process returned only a small number of studies after results were screened and subjected to the exclusion and inclusion criteria. Consequently, a broader search was conducted, which included further databases to locate more studies on the topic for the SR and to increase the conclusions' quality(Ten Ham-Baloyi & Jordan, 2016).

Table 3: Electronic Databases Used

Cumulative Index to Nursing and Allied (CINAHL)	EBSCO	MEDLINE (Web of Science)
Saudi Digital Library (SDL)	Ovid	Academic Search Premiere
Cochrane Library for Systematic Review (CLSR)		

2.8.2 Search Terms

The terms employed in the search are: clinical skills, student nurses, skills, high-fidelity of simulation, technical skills, improve* or teach* undergraduate nurses. The grouped key word searches were as follows: [technical skills, psychomotor skills and clinical skills]; [improvement, teaching]; and [student nurse, undergraduate nurse, pre-licensure nurse]; these used Boolean And/OR. Table 4 presents the keywords:

Table 4: Keywords Searched

High-fidelity simulation, HFS, simulate*	Student nurses, Undergraduate nurses, baccalaureate nurses, pre-licensure nurses	Clinical skills, skills, technical skills, psychomotor skills
Teach, improve*		

2.9 Criteria for Including/Excluding Studies from the Systematic Review

2.9.1 Inclusion Criteria

This review included research conducted with undergraduate student nurses. The study specifically included studies that included the keywords: [simulation, high-fidelity simulation], [undergraduate nursing student, baccalaureate, student nurse, pre-licensure nurse], [clinical skills and technical skills, psychomotor skills], and [improve*, teach*]. This plan was to ensure that the selected studies aligned with the study's aims and objectives, which revolved around how HFS can improve clinical skills. The other criterion for inclusion was that studies presented information on HFS utilisation in teaching clinical skills to nursing students. Moreover, studies published from 2008-2018 were included to identify updated studies; this criterion was used as part of the inclusion criteria to ensure that up-to-date information was obtained. Specifically, HFS is a new area of nursing and healthcare research; hence, research that is up-to-date with technological innovations is required for the review to be reliable. Additionally, only full text articles were included in the study, and also, all had to be published in English, as the entire study had to have been completed in English, and also because of the time-scale for the review, in which translation would not have been practical. Lastly, the review did not impose methodological limitations, in order for different qualitative and quantitative studies to be included.

2.9.2 Exclusion Criteria

Those studies that did not include the keywords were excluded, withnecessary words including: "clinical skills, technical skills", "student nurse" "high-fidelity simulation, simulate*". Furthermore, the research focused on other criteria, such as excluding studies from other languages apart from English, published prior to 2008, and those that did not have full texts. Meanwhile, qualified nurses and other healthcare professionals who were not nurses were excluded from the study, as the focus was on student nurses. Studies using non-technical skills, such as decision making, low-fidelity simulation, medium-fidelity simulation, or simulation using a simulated patient were also excluded. Table 5 lists the inclusion/exclusion criteria used in the review.

Table 5: Inclusion/Exclusion Criteria for the Systematic Review

Inclusion Criteria	**Exclusion Criteria**
Participants were nursing students or through studies that also included these student nurses.	Participants did not include nursing students.
Empirically improved the clinical skills of these student nurses by using HFS.	Did not empirically improve or offer information regarding the clinical skills of these student nurses by using HFS.
The use of important keywords: [high-fidelity simulation], [student nurse, under graduate nurse, baccalaureate nurse, pre-licensure nurse], [Clinical skills, skills, technical skills, psychomotor skills], [improve*, teach*].	Those studies that did not include the keywords. Also, studies with: qualified nurses, other healthcare professionals; non-technical skills e.g. decision making; low-fidelity simulation, medium-fidelity simulation were excluded.
Published year range from 2008-2018.	Fully published research completed prior to 2008.
Full text available.	Full text not available.
English language.	Languages non-other than English excluded.
Studies that included clinical skills, technical skills, and/or psychomotor skills	
Did not use methodology limitations.	

2.10 Search Outcomes

For the outcomes, there were differences in study types of,as each database has its unique purpose in regards to nursing and healthcare research. Cochrane helped to identify healthcare studies (Bramer, Giustini, de Jonge, Holland & Bekhuis, 2016), while Medline was confined to biomedical literature (Furlan et al., 2015). The trustworthiness of outcomes was evaluated based on the hierarchical degree and evidence hierarchy

(Bramer et al., 2016); while comparatively, some were based on the study design and how they aligned with the current study (Stovold, Beecher, Foxlee & Noel-Storr, 2014). The search results are identified in the PRISMA diagram (see Figure 2), which shows how information flows throughout the systematic review process (Stovold et al., 2014). A total of 759 articles were retrieved, with 512 articles included after duplication screening. From these, 302 were screened and included based on their abstracts, and 210 were excluded, as they did not contain keywords. 92 articles were assessed for eligibility, 50 were excluded, another 42 were screened and 34 excluded, and the study identified 8 articles as fulfilling the eligibility criterion for inclusion.

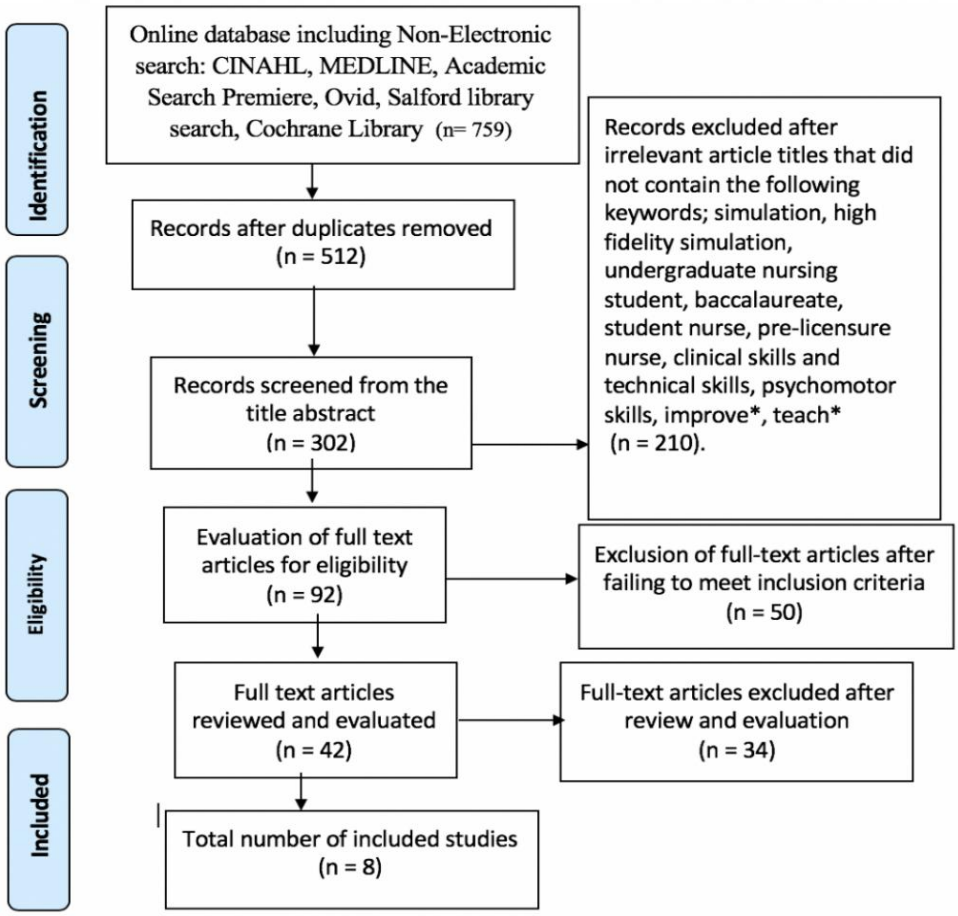

Figure 2: PRISMA Diagram of the Search Results and Selection Process

2.11 Results' Analysis

Evaluating the quality of studies is one of the major areas of consideration when conducting systematic reviews, whose emphasis is on reducing error and bias risks in the results (Moons et al., 2014). Additionally, this includes analysing and evaluating quality, specifically aims to address and assess the validity of the included study, including the research methodology and interventions which were measured in the conducted study (MacGill, 2017). Meade and Richardson (1997) state that an unreliable SR stems from biased studies that create ambiguous or false results. As a result, numerous checklists for appraisal exist that provide quality and validity evaluation of studies (Cochrane Collaboration, 2014).

The CASP checklist was used in this review to assess each study's accuracy (Quigley, Thompson, Halfpenny & Scott, 2018). Accordingly, Horsley et al. (2011) emphasise the need for peer-reviews of SRs,alongside detailed discussions and data analysis, together with results and their implications.

2.12 Data Extraction

According to Moons et al. (2014), data extraction involves data collection which addresses the requirements of the review from the studies identified. In this case, the extraction had to include characteristics, outcomes, results and references. However, challenges associated with extraction include problems with personal bias and errorswhen extracting data, asgenerally, only positive outcomes that align with the research question are included (Moons et al., 2014). For the current review, a tabulated format was applied to summarise the relevant articles(see Appendix 2).

2.13 Data Synthesis

Data synthesis functions to gather and summarise meaningful results from the identified primary studies (Moher et al., 2015). Results' findings are obtained using meta-analysis or a narrative technique. However, for the meta-analysis, they are only applicable with dichotomous data;thus, applied when there is adequate homogeneity in the selected data to produce meaningful data summary (Moher et al., 2015). Therefore, this study used a narrative approach to present or analyse the data.

2.14 Summary

Even though systematic reviews are sometimes challenging regarding the complexities and time required, this chapter also highlights the need to gain or identify the most up-dated evidence. Therefore, it has shown how SRs includea search strategy, the criteria to select studies and extract data, and a method to analyse the findings. Subsequently, Chapter Three analyses the eight studies selected for final review, in order to deliver new insights into the study area.

Chapter Three:Findings

3.1 Introduction

This chapter analyses the results from the 8 selected studies on how HFS improves clinical skills (technical skills). All have been evaluated on the basis of knowledge areas, such as how HFS improves knowledge retention on specific clinical skills or how individual students improve their knowledge of clinical skills when taught through HFS.

3.2 Methodological Quality of the Included Studies

Shea et al. (2017) report that a critical appraisal refers to the method to systematically analyse identified research to assess a study's validity, relevance, and reliability for the specific or particular context. Out of the 8 articles: 5 were quasi experiments; 1 a retrospective comparative study; and 2 RCTs. This SR used a critical appraisal checklist that included 11 set questions (see Tables 6-8). The questions assist in simplifying the studies' assessment and appraisal methods, in order to identify their levels of trustworthiness, reliability and effectiveness within practice. The critical appraisal helped to evaluate thestudies' quality, as well as strengths and limitations (Aveyard, 2010).

Table 6: Randomised Controlled Trials"Critical Appraisal"

Study	**Chen, Grierson and Norman (2015)**	**Aqel and Ahmad (2014)**
A. Are the results valid? (Screening question)		
Did the trial address a clearly focused issue?	Y	Y
Was the assignment of patients to treatment randomised?	Y	Y
Were all the patients who entered the trial properly accounted for in the conclusion?	Senior nursing students (n=120)	Second-year nursing students (n=90), all reported in post-test
Were patients, health workers and study personnel 'blind' to treatment?	Y	Y
Were the groups similar at the start of the trial?	Y	Y
Aside from the experimental intervention, were the groups treated equally?	Y	Y
B. What are the results?		
How large was the treatment effect?	Statistical significance, F (2, 57)=21.98, with p<0.001	(t = 8.05; p .001) noted in the two groups, the intervention group (M = 12.27; SD = 1.13) when compared to the control group at (M = 10.07; SD = 1.43)
How precise was the estimate of the treatment effect?	Significant (P<0.01)	Significant (P<0.001)
C. Will the result help locally?		
Can the results be applied in your context?	Y	Y
Were all clinically important outcomes considered?	Y	Y
Are the benefits worth the harms and cost?	Y	Y

(CASP, 2018)

Table 7: Quasi-experimental Design "Critical appraisal"

Study	**Curl et al. (2016)**	**Pauly-O'Neill and Prion (2013)**	**Scholes et al. (2012)**	**Kirkham (2018)**	**Traynor et al. (2010)**
A. Are the results valid? Screening question					
Did the study address a clearly focused issue?	Y	Y	Y	Y	Y
Did the authors use an appropriate method to answer the question?	Y	Y	Y	Y	Y
Were the cases recruited in an acceptable way?	Y	Y	Y	Y	Y
Were the controls selected in an acceptable way?	Y	Y	Y	Y	Y
Was the exposure accurately measured to minimise bias?	Y	Y	Y	Y	Y
Have the authors taken account of potential confounding factors in the design and/or analysis?	Y	Y	Y	Y	Y
What are the results of this study?	[1, 95)=3.87, and the p value was =0.05 in comparison to the traditional group mean, which was 875.98; STRIPES team recorded higher mean of 942.82, statistically reported as F [1, 95)=6.81 while the p value was =0.1.	M=95, SD=6.8, high compared with MAE score FOT control group M=90, SD=12.9, p value =0.004 while t=2.92 and df=118.	A medical Emergency teams called for assistance by 15 (43%) of student midwives, 20 (57%).	t inquiry and advocacy are essential as they are crucial in aiding students' understanding and reflection of the experience of the scenario.	p<.001, as well as the participants with higher cumulative GPAs, p<.05.
B. What are the results?					
How precise are the results?	Significant (P<0.1)	Significant (P<0.004)	P<.001	P<.001	p<0.05
Do you believe the results?	Y	Y	Y	Y	Y
Can the results be applied to the local population?	Y	Y	Y	Y	Y
Do the results of this study fit with other available evidence?	Y	Y	Y	Y	Y

(CASP, 2018)

Table 8: Retrospective Comparative Quantitative Study

Study	**Curl et al. (2016)**
A. Are the results valid? Screening question	
Did the study address a clearly focused issue?	Y
Did the authors use an appropriate method to answer the question?	Y
Were the cases recruited in an acceptable way?	Y
Were the controls selected in an acceptable way?	Y
Was the exposure accurately measured to minimise bias?	Y
Have the authors taken account of potential confounding factors in the design and/or analysis?	Y
What are the results of this study?	High-fidelity simulation led to increased critical thinking and practical skills: (249.71) = 5.53, p < .01; 95 % CI (lower limit = 0.08, upper limit = 0.16).
B. What are the results?	
How precise are the results?	Significant (P<0.01)
Do you believe the results?	Y
Can the results be applied to the local population?	Y
Do the results of this study fit with other available evidence?	Y

3.3 Randomised Control Trials (RCTs)

This section appraises the RCTs included,of which 2 were identifiedusing a systematic approach, and the inclusion criteria were applied to identify studies on the use of HFS in nursing students and how it improves knowledge of clinical skills. Correspondingly, the sample was deemed fit for this study based on the search criteria, alongside the inclusion and exclusion criteria, where the review was only able to identify 2 RCT studies.

3.3.1 EthicsApproval

For the RCTs, all received ethics approval, which is vital in research that deals with humans to safeguard participants' safety and rights (Mc Cord et al., 2018). Ethics approval was obtained from the relevant institutional and research ethical review committees to protect individuals against harm, ensure confidentiality and privacy, and avoid data inaccuracy. The overall emphasis is that each research subject should be entitled to safety, respect, andautonomy to continue or withdraw (Herrett et al., 2015).

3.4 Retrospective Comparative Quantitative Study

One of the studies was a retrospective study with a design looking backwards and examining exposures to risks or protection factors that are relative to an outcome identified previously (Sedgwick, 2014a). The design was suitable for the current study, as retrospective studies entail regressing and identifying a population at a specific point before they developed specific outcome of interests, while trying to establishing the status of exposure at the time; thus, determiningwhether the subject developed the measured outcome(Sedgwick, 2014b).

3.5 Included Studies

The findings from the eight selected studies are synthesised, taking into consideration the design of each study. Table 9 below shows the overview of the included studies.

Table 9: Overview of the Included Studies

Literature/journal	Location/Country	Population	Area of study	Professional Methods	Results
Hall (2015)	The US, North Carolina, at a university which traditionally has had a large percentage of black students.	Baccalaureate nursing students (n=137 for simulation students and n=47 for non-simulation students)	Efficacy of HFS within senior maternity baccalaureate nursing programmes.	Retrospective comparative quantitative study,	HFS improved practical and critical thinking skills.
Chen, Grierson & Norman, (2015)	Laerdal Medical A/S, Stavanger, Norway	Senior nursing students (n=120)	HFS and LFS for clinical education in cardiac/respiratory auscultations and physical assessment skills.	Randomised control trial	HFS and LFS on cardiac and respiratory auscultation and physical assessmentskills.
Curl et al. (2016)	The USA	Simulations and clinical experiences (STRIPES) n=58 Control group n=65	Effectiveness of integrated simulation in comparison to stand-alone traditional teaching.	Quasi-experimental study	Integrated simulation improves clinical skills.
Pauly-O'Neill & Prion (2013)	Mid-western, The USA	BSN nurses n=79 for intervention group, n=79 for treatment group	The use of simulation-based teaching methods in improving medication administration exam outcomes.	Quasi-experiment pilot study	Simulation improves medication administration and reduces medication errors or adverse events.
Scholes et al. (2012)	Australia	Midwifery student nurses, n-35	Simulation based instruction enhances clinical decisions of student midwives, enhancing their ability to recognise and respond to post-partum haemorrhage.	Quasi-experiment	Clinical decision-making in emergency (for midwifery students).
Kirkham (2018)	USA	9 nurse students and 3 level 1 medical students	Simulation-based training and improved knowledge on patient safety.	Quasi-experiment	Patient safety precautions and decision making.
Aqel & Ahmad (2014)	Jordan	Second-year nursing students (n=90)	HFS and training in CPR skills and knowledge retention.	Randomised control trial, pre-test/post-test study	HFS helps to improve CPR skills' acquisition and knowledge retention.
Traynor, Gallagher, Martin & Smyth (2010)	Northern Ireland	Third-year adult branch nursing students (n=90).	Simulation gave student nurses a perspective on the qualified nurses' roles. Improving the understanding of the theory-practice relation	Quasi-experimental design	Simulation gives student nurses a perspective on qualified nurses' roles,and also improves understanding of the theory-practice relation.

3.5.1 Retrospective Comparative Quantitative Study

Study 1: Hall (2015)

Hall (2015) conducted a retrospective study examining how HFS is effective in senior maternity Bachelor of Science in Nursing (BSN)programmes. Specifically, the aim and emphasis of the study was based on whether instructions received through HFS, along with traditionalhospital-based clinical training, would lead to the achievement of greater practical learning, National Council Licensure Examination (NCLEX)(a nationwide examination licensing nurses in the United States) performance potential, and critical thinking skills. The study stemmed from that nursing education has faced a lack of clinical experience for students to enable them to apply theory into practice. Moreover, the authors were guided by the notion that senior maternity students do not gain hands-on experience through traditional hospital-based instructions, as they barely entail the same type of patients introduced in classrooms. Conversely, they espoused that high-risk units may not be ideal for students, as they always have low census, of which certain students are left without patients;consequently, have limited opportunities to practice essential skills.

In addition, a retrospective comparative quantitative study was applied with the setting being North Carolina while ethical consideration was respected by obtaining authorisation from the Dean of Nursing, and the Walden University Institutional Review Board. For the study, the treatment was HFS using computer programs and usedAssessment Technologies Institute (ATI), which is usually utilised in content mastery series' tests, and always applied in testing the overall effectiveness of simulation, with a proctored and timed test, including 60

multiple-choice questions. The tests focused on three scenarios, including postpartum haemorrhages, pregnancy-induced hypertension and placental abruption. The tests were identified based on questions that tested critical thinking and practical skills. Through testing NCLEX performance prospective, the researchers applied ATI proficiency levels, which were assessed as level 3 (85-100), level 2 (71.7-83.3%) and below level 1 (63.3-70.0%).

From the findings, inferences or conclusions were made after using descriptive statistics for the measurement levels in examining the independent variable mean, alongside the mean, and the same for the dependent variable for standard deviation mean and median, together with the maximum or minimum variables (measures for variability). The authors also conducted an independent sample t-test to measure the significant differences between groups. They reported that the t-test showed major differences between the intervention and non-simulation group, $p<0.01$. Moreover, the study reported that 133 participants were observed within the simulation group, representing 90.5% of the group, which scored from level 2 and above, and equally a show that the students were likely to exhibit exceeding performance of the NCLEX expectations. In comparison, only 81 students from the non-simulation group scored level 2 or above (see Table 10).

Table 10: Descriptive Statistics; for Proficiency Potential by the Instructional Group

Simulation group			Non-simulation group	
Proficiency	N	Percent	N	Percent
Level 0	0	0.0	7	5.3
Level 1	14	9.5	44	33.3
Level 2	126	85.7	76	57.6
Level 3	7	4.8	5	3.8

(Hall, 2015)

From the findings, the authors espoused that HFS helps in providing students with excellent opportunities to engage realistic application of theories and helps to transfer knowledge into practical skills, while simultaneously improving critical thinking. This research has profound implications for the current study, as it confirms the efficacy of HFS in improving practical and critical thinking skills among student nurses. Separately, there were also different RCTs that provided further knowledge to the subject area.

3.5.2 Randomised Control Trials

Study 2: Chen, Grierson and Norman (2015)

Chen, Grierson and Norman (2015) based their study on the justification or notion that HFS is simply closer to reality, and subsequently, motivates students to learn. Consequently, the students will be better at performing and transferring their learning when faced with real patients. The study compared the effectiveness of both HFS and LFS regarding their outcomes when used in education and training cardiac and respiratory auscultation, while simultaneously assessing how they enhance or improve nurses' assessment skills , which target senior-level nursing students; a sample size of n=60 (senior undergraduate nurses). All participants got randomised into LF and HF and control groups, recruited between 2008 and 2009 summer periods. Both the LF and HF had instructions provided on paediatric sounds including: holosystolic murmur; mid-systolic, click diastolic murmur, continuous murmur; systolic murmur, and normal. The participants were the same in HF and LF, as well as the control group, but the LF and HF were further provided with instructions on respiratory sounds, including: stridor, wheeze, rhonchi, normal and crackles. However, for the control group, there was no instructional intervention provided. The measurement included looking at auscultation examination outcomes (the same for both HF and LF).

The study reported the overall differences between the two study groups and indicated greater statistical significance, $F(2, 57) = 21.98$, with $p<0.001$. An insight from this study was from the overall results of the statistical analysis; the LFS instruction group reported superior auscultation examination outcomes or performance in comparison to the HFS training group. Meanwhile, both revealed improved overall practice outcomes, compared to the control group. In addition, tests were performed on areas, such as near transfer or new sounds, with the same pattern showing that the LFS group recorded better performance in comparison to the HFS group; while comparatively, the control group recorded the lowest performance.

Table 11: Auscultation Test Scores and Cardiac and Respiratory Test Subscores in the High-Fidelity (HF) and Low-Fidelity (LF) instruction Groups and the Control Group

	HFS	LFS	Control
Total score, mean +/- SE	46.79+/-	57.72 +/- 2.44	32.50 +/- 2.77
New sounds percentage score	48.13+2.64	57.30+/- 3.07	32.50 +/-2.77
Old sounds total score	43.65+- 3.72	58.70+/- 3.29	N/A

(Chen et al., 2015)

Table 11 summarises the results, where tests were conducted on new and old sounds. In both cases, the LFS instruction group recorded better performance, as shown from the positive standard deviation scores, which in essence, highlights or indicates the effectiveness of LFS in capturing auscultation sounds in comparison to HFS.

The authors showed and challenged the initial notion that HF authentic simulation is always the prerequisite for the successful transfer of knowledge into real or actual clinical environments. Additionally, it challenges that the effectiveness of HFS had been based on limited empirical evidence by Baddeley and Godden(1975) basing the effectiveness of HFS on outdated approaches(i.e. practical reciting and word memorisation). Therefore, the study shows that HFS does not have greater advantage over LFS; hence, it should be considered in clinical nursing education or training. Similarly, Aqel and Ahmad (2014) presented a different RCT study.

Study 3: Aqel and Ahmad (2014)

Aqel and Ahmad (2014) aimed to explore how HFS can improve knowledge and skills retention and acquisition among undergraduate nursing students. The method used was a randomised two-arm trial utilising two different educational approaches targeted at 90 nursing students, all randomly assigned to the two groups.The participants were nursing students all enrolled in their first adult health nursing course with no prior experience of cardiopulmonary resuscitation (CPR), conducted within a nursing laboratory situated at the University of Jordan.The basis for their study was that HFS helps to provide nursing undergraduate learners with exceptional collaborative learning experiences in safe and well-ordered environments, of which students have opportunities to practise without worrying about harming patients. Moreover, it challenged that, despite the overreliance on traditional classroom teaching as the sole method for providing clinical knowledge, simulation provides opportunities for experimental learning that is necessary to enhance students' skills and knowledge.

The researchers supported that, despite the inherent advantages of traditional teachings, such as aiding with the clarification of unfamiliar concepts, when used with simulation or interactive learning, students' knowledge acquisition is enhanced. Specifically, the study focused on the retention of cardiovascular resuscitation skills and knowledge, with nursing students reporting to have clearly appreciated simulation-based education to be effective; presented real contexts on the basis of increasing confidence of students regarding their abilities to perform CPR. The researchers were further grounded by the notion that clinical teaching based on simulation improves the learning of psychomotor skills, and develops the efficacy in critical thinking among students. The study used an experimental, pre-test/post-test design, using second-year nursing students, and assessed the efficacy of LFS and HFS in retaining CPR skills and knowledge.

The two groups were compared regarding how they acquired both knowledge and skills of CPR following training. The authors used an opposite t-test, which indicated that each group had expanded noteworthy understanding from their corresponding training methods. For the control groups, the post-test scores in CPR knowledge ranged from 9-13 measured against the possible 14 points. Comparatively, the intervention group showed higher scores, which ranged from 10-14. Meanwhile, for the control group, CPR skills' scores ranged 8-14, while for the intervention group, this was 10-14. Also measured and assessed was whether a substantial dissimilarity in the knowledge gained existed, with an independent t-test performed. The researchers reported significant differences in the post-test CPR knowledge and the CPR skills, which were found to be higher among the intervention group. Additionally, the authors measured knowledge retention and how this differed among the two groups. For the control groups, the retention scores were noted to be 7-12, measured against the possible 14 points and for the intervention group, the score in this metric ranged 7-14.

The researchers further conducted a dependent sample t-test, which shows a major difference, represented by p.001 noted in the two groups. For the intervention group, the statistical results indicated M = 12.27 or controlled for the mean and their standard deviation SD = 1.13). In comparison to the control trial, the mean was found to be M=10.07, while computing for their standard deviation, the authors reported SD=1.43) in knowledge retention after 3 months' training. Furthermore, the researchers performed paired t-test to examine the parity in CPR skills, as well as skills to measure the retention levels of the group. From the results, the authors noted that regarding CPR knowledge retention, the control group had a score of 7-13, while for the group used as a control the score ranged 8-14. In addition, from the independent sample -test, the CPR retention skills' difference was at p=0.001.

The results from the study have profound implications for the current research by noting the effectiveness of HFS in acquiring and retaining knowledge and skills. Consequently, the inference from the research is that for nursing educators, there is the inherent need to integrate simulation as part of curriculum training. This will be a solution to overcome the challenges facing many courses, and specifically the serious shortages being faced in clinical areas of training and in increasing the amount of nursing students. The study also highlighted that HFS leads to better knowledge and skills retention than LFS. In regards to the other

analysed reviews, the following five studies were all quasi-experiments that evaluated the function of HFS in the nursing education development.

3.5.3 Quasi-Experiments

Study 4: Curl et al. (2016)

Curl et al. (2016), using a quasi-experiment design, sought to evaluate how HFS is effective in replacing 50% traditional clinical experiences in mental health, critical care, paediatrics and obstetrics. The participants were randomly assigned to two groups, one being the experimental intervention, combining simulations and clinical experiences (n=59), and the other a control group exposed to traditional learning experiences (n=65). However, the study did not explain or report ethical considerations, and was conducted in a clinical setting in the USA, although follow-up after 3 months on to measure the outcomes was included in the evaluation of the effectiveness of the intervention.

The authors based the study on the premise that nursing knowledge is undergoing exponential growth; the challenge for nursing educators is how to meet shortages in respective faculties, and the problem of being presented with limited or few clinical sites. Moreover, the study sought to address problems of low admission rates in areas where clinical or nursing education and training resources are limited. Hence, the authors sought to help nursing educators to increase their nursing programmes through collaborating and sharing clinical resources, of which innovative strategies, such as HFS, have been recommended as feasible and effective. Therefore, the researchers engaged in a quasi-experiment to test whether students engaged in HFS. The students were provided with clinical experiences within real healthcare settings to gain as many skills and knowledge in comparison to those students that are exclusively assigned to traditional clinical experiences. For the intervention group, they were assigned clinical experiences and simulations, while the control group was given traditional learning experiences. Southeast Texas Regional Innovation Project on Effective Simulations (STRIPES) was the intervention group, rotating between the central HFS Lab and those assigned to healthcare clinical agencies used by mental health, paediatrics and critical care taught using simulation. As participation was on a voluntary basis, the study addressed bias in self-selection by using baseline pre-test for both groups.

The study reported insightful findings, as it indicated that the Southeast Texas Regional Innovation Project on Effective Simulations (STRIPES) group recorded a higher statistical mean of 938.56 for the post-test, reported as F[1, 95)=3.87, and the p value was =0.05 in comparison to the traditional group mean, which was 875.98. For the overall exit example, the STRIPES team recorded a higher mean of 942.82, statistically reported as F[1, 95)=6.81, while the p-value was =0.1, higher than the mean of the traditional group, which was 878.87. Therefore, the study reported that the STRIPES group showed greater knowledge in comparison to the traditional group.

Table 12: Demographic by Group

Variable	STRIPES	Traditional	Total (N)
Group	N=59(47.6%)	N=65(52.4%	N
Associate Degree Program			
LVL Articulation	39(31%)	56(45%)	95(76%)
Basic ADN	20(16%)	9 (7%)	29(23%)
Gender			
Male	8(6.5%)	8(6.5%)	16(12.9%)
Female	51(41.1%)	56(45.2%)	107(86.3%)

(Curl et al., 2016)

From the findings, the authors made profound conclusions. Specifically, they indicated that HFS can be an effective strategy in education and used alongside traditional clinical experiences or integrated into curricula. Nonetheless, the simulation modules' effectiveness can only be assessed when pre-lab activities are introduced for establishing the students' baseline knowledge. The authors also espoused that an hour of HSF is the equivalent to traditional clinical experience when debriefing and pre-lab activities include HFS. Furthermore, to expend equipment and faculty resources, there is the inherent need for collaboration in developing simulation labs.

Study 5: Pauly-O'Neill and Prion (2013)

Pauly-O'Neill and Prion (2013), through quasi-experimental design, aimed to identify whether a mixed-educational approach incorporating simulation improves medical administration among junior level nurse professionals, exposing junior level nurse students for 40-50 hours of HFS in paediatric unit, exposed to completing the scenarios presented with medical prescribing and system-based pharmaceutical error, acute reaction to drugs and unpredictable medication dilemma. The study was conducted in an urban university in

West Coast, USA, with the Institutional Review Board for the Protection of Human Rights reviewing for ethical considerations.

The study was based on medication administration as the major role for professional nurses. Hence, nurses are often primary targets of any errors on medication or medication error prevention efforts. Accordingly, the researchers referredto Levinson (2010), who reported how medication errors are attributed to a larger percentage of patient fatalities, which were assessed when a 780 sample of Medicare patients were surveyed. The study was also undertaken in the USA, whereby the researchers reported that the Institute of Medicine (IOM) has been apprehensive about the increasing cases of adverse patient events; apparently 1.5 million individuals are affected by severe drug errors, which can generally be prevented (IOM, 2006). Therefore, the researchers focused on a quasi-experimental pilot study that was focused on determining how simulation methods, in comparison to traditional teaching methods of teaching and learning, are effective in medication calculation, alongside the abilities of medication administration among BSN student nurses with the outcomes measured against medication administration examination. Additionally, of concern was that prior to the study, 25% of the junior-level students who had taken the administration examination had failed to demonstrate mastery of the content (achieving 90%+). For the study, it relied on purposive sampling from two groups, with the overall or total population at N=158. The student groups were divided equally, n=79, with one assigned a dedicative traditional review to function as the control, while the simulation group as the intervention.

In the control group, the students were only assigned traditional medication administration, as always conducted in classroom contexts under the direction of instruction from the nursing faculty course records. The traditional method entailed a calculation demonstration, a slide presentation, and interactive discussions to address every question for each medication order, which were similar to those in acute settings, including IV, oral and intramuscular administration methods. In the intervention group, simulation methods were used in the medication administration review. Under the supervision of the faculty participant, students were allocated to work through the medication calculation, and through administration using simulated medication and appropriate equipment, such as needles, syringes, syringe drug delivery systems, and medication vials.

The authors reported that mean-square error (MAE)scores were higher for the group that had received the intervention with the mean reported at M=95 and the standard deviation at SD=6.8, which was reported as a higher value than the control group, that had a mean of M=90 and their standard deviation was SD=12.9, which they analysed at the p value =0.004,with t=2.92 and df=118. The authors concluded that simulation methods are essential in improving BSN understanding and performance on MAE. In addition, the methods have been indicated and confirmed to augment the understanding of vital nursing concepts among students, together with both clinical and didactic areas of clinical or nursing education. The implication of this study is that simulation methods should be considered and reconceptualised in nursing education by the nursing faculty, not merely for teaching tools for clinical situations, but also as used by a larger number of students for the multitude of nursing education-related issues, such as medication administration. Similarly, a study by Scholes et al. (2012) was conducted in the UK that provided a quasi-experimental method.

Study 6:Scholes et al. (2012)

Scholes et al. (2012) was a quasi-experimental descriptive study to expose students to necessary instructions for managing maternal deterioration, and their responses to obstetric emergencies; thus, this embedded it as part of the curriculum. The aim was to report the responses of midwifery students to simulated post-partum haemorrhage (PHH). Ethical consideration was ensured through University Human Research Ethics Committee with the students being made aware of the unknown observers in the UK. The data collected through video observation, was analysed using Dimensional Analysis. The study randomly recruited 35 students (n=35). Participation also included: video recordings of the students' performances in a simulated environment; video-cued narratives reflecting their performance; experience evaluation; and a knowledge question. The simulated scenario was constructed from amalgamated maternal incident reflections, as a board of clinical specialists were used to assess the scenarios, which confirmed the content and face-validity. The simulation was conducted individually, and interaction was permitted with the researcher, who ensured that his identity was concealed by posing as a junior doctor. The role of the junior doctor was to provide help and guidance with prescription medication, or even when undertaking medical procedures. Therefore, the overall emphasis of the study was upon inquiring the capacity of students to recognise and respond to the deteriorating condition or to make timely requests to obtain assistance and increase calls for assistance from senior or advanced nurses. The study also observed delays in emergency response team arrivals, which was considered essential when observing the potential of students' emergency management skills.

This study was informed by the reports indicating how midwifery students have responded to PPH. In addition, the study reported that on the international stage, 25% of overall maternal deaths are linked to severe haemorrhages. Irrespective of the prevalence of the problem, it risks both maternal well-being and child health; therefore, there is the inherent necessity of midwives to remain vigilant and respond suitably to the primary

symptoms of deteriorating maternal health or well-being. Owing to this revelation, the focus was to describe how student midwives can make decisions and the approach they use in responding to obstetric emergencies. Also, it proposed that there is the opportunity to enhance decision-making among student midwives, and their clinical skills through simulated PPH.

Furthermore, the study reported and noted the considerate variations in clinical management skills and student nurses' competency. For instance, they reported that students struggled to prioritise their actions in scenarios requiring more than one response towards the clinical cue, and to have little intention when using mnemonics to act as their heuristic devices, which are essential in action guidance. In addition, the results indicated that a single action as the basis and motivation for responses led students to become reluctant in devising solutions deductively. Therefore, through simulation, the students introduced relevant novel ideas and concepts.

Table 13: Summary of the Students' Responses (n=35) to PPH Scenario using Key Clinical Management Strategies

Final Message	Oxytocic	Assessing blood loss	Calling for help	Checking placenta
68% intermittent fungal massage 30% performed continuous funal massage.	18 students did correct oxytocic timely, 14 (40%) called for syntocinon and 4 called for ergomerine.	All 35 visually checked for the place loss.	11 or 31% showed the need for calling medical help.	13 or 37% checked the placenta's status.

(Scholes et al., 2012)

The implications indicate that there is the necessity to update clinical skills among students on a regular basis, especially: the use of emergency standing order medication; fundal massage approaches or methods; communication skills; the delegation of tasks in emergency situations; as well as working independently before others arrive. The study reported that heuristic devices are essential to help students' evaluation of their interventions and aids to highlight what is necessary to be conductedwhile waiting for emergency teams. The heuristic devices used in this case were simulation-based materials. Consequently, the study's findings affirm that HFS helps to improve the student nurses' overall clinical judgment; consequently, is useful in enhancing clinical or critical decision making. As with Scholes et al. (2012), another quasi-experimental study was conducted in the UK by Kirkham (2018)

Study 7: Kirkham (2018)

Kirkham (2018) through a quasi-experimental design main explored inter-professional work, and how it can be enhanced or improved through simulation. For the study, HFS was an assessment on how students would respond to the deteriorating health of a patient using 9 student nurses and 3 level 1 medical students. In the first session, 3 nursing students and 1 medical student were assigned to learn through simulation as the main emphasis of the training session (using patient simulator manikins), while the rest were to observe the simulated scenario, who only participated in the debrief section of the experiment. The study was undertaken in the UK within midwifery (maternity setting), although there are no explanations on ethical consideration or even a review committee that assessed and reviewed the study for ethical considerations.

The study provided the opportunity for students to swap their roles. Therefore, both engaged in simulated scenarios and the observer's role. The study also considered that measuring the effectiveness of training or learning outcomes would be most beneficial if students were assessed, in order to identify skills gaps and how it was possible to address these gaps. Comparatively, an important consideration was that students' learning styles had to be incorporated into the assessment as a way of ensuring that their learning styles were evaluated for the subsequent study's level. The research, therefore, divided the learning outcomes to assess technical and non-technical skills among students. The technical skills included how students could safely undertake ABCDE assessment and correctly complete the National Early Warning Score, inclusive of undertaking clinical observations. The tested non-technical skills included how the students would exhibit active communication, and inter-professional team-working skills showing their situational awareness and understanding for when it is necessary to call for assistance and undertake structured SBAR.

The authors were guided by the notion that ineffective communication and teamwork are some of the foremost sources of avoidable human clinical faults, which are always attributed to patient injuries or in extreme instances, death. Moreover, the research was based on the fact that inter-professional education remains a vital element in nursing education and training, and therefore, could be considered by nursing educators. The relevance and implications of the research are provided in the study's reflection section. In particular, it shows that simulation and debriefing help to promote patients' safety in clinical practice. The facilitator or instructor plays a vital role, and there is the need to discover the right environment by using the correct apparatus and presenting an expedient scenario as crucial in meeting the students' learning outcomes. Moreover, the study showed that inquiry and advocacy are essential, as they aid students to understand and reflect on the experience

of the scenario that they have simulated, without being critiqued on their individual performances by the facilitator.

The overall inference shows that simulation training is essential and necessary in improving knowledge, alongside the performance of technical or non-technical skills. Simulation should include virtual reality, role play, and patient simulators. Hence, it helps to link theory and practice that is essential in developing technical, teamwork and communication skills among nursing students. Meanwhile, the effectiveness of simulations depends on extensive preparation and a debriefing session to assist students with the reflection of the experiences and to grasp what has been learned throughout the session. Therefore, for the effectiveness of simulation, its success should be measured based on how it has assisted students in practicing clinical techniques within a safe environment, together with understanding the consequences of decisions and actions during the practice, together with practising what has been learned.Likewise, as with this UK based study, Traynor et al. (2010)provide useful findings from their Northern Ireland based study.

Study 8: Traynor et al. (2010)

Traynor et al. (2010) reported about HFS and how it could be used in nursing curricula for undergraduates to develop confidence and proficiency without compromising patient safety. The sample used was of third-year students (n=90), who are considered to be adults, focusing on Northern Ireland's nursing curriculum, with students attending training. Each 4-hour session contained a group of 6 students for 8 days; all exposed to three HFS.

The findings indicated that the simulation aided the students' development, and the interaction between theory and practice. Similarly, there were reports from students regarding how they valued and appreciated experiences which they regarded as necessary and useful in highlighting the inherent knowledge gap, while simultaneously providing them with the confidence and ascription or aspiration to succeed in future clinical practice.

3.6 Summary

This chapter has synthesised the relevant studies that were included as part of the systematic review. The findings of the review support the effectiveness that simulation plays in improving skills and knowledge retention among nursing students. Most studies have compared HFS and LFS, with a larger percentage finding HFS to show superiority in improving clinical skills and knowledge retention among students. HFS has been equated with pragmatic or practical learning and how the hands-on experience helps in retaining knowledge and improving technical skills. Furthermore, the chapter has shown that although various approaches to fidelity simulation like LFS could be effective, HFS should be the focus of nursing education, as it entails a high modified clinical learning or teaching environment that provides real life clinical management scenarios to enhance learning and knowledge retention. Therefore, the reviewed studies suggest that there are clinical and nurse education implications for implementing HFS within education and teaching approaches, where the model should be integrated as part of learning or teaching. Chapter Four precedes this section by offering a detailed discussion of the findings and links the review's findings with existing research, whilst also explaining whether the findings have answered the research question.

III. Discussion of the Findings

4.1 Aim of the Chapter

This chapter focuses on discussing the findings by comparing what the identified studies argue to be the elements of HFS that make it an effective teaching method in enhancing clinical skills. A compare and contrast method was used in this discussion to outline the efficacy of HFS in improving clinical skills among students, whether there are differing opinions and if perhaps, there are studies that refute the effectiveness of the method. Moreover, the discussion is connected to the grounded literature, especially those that have supported simulated teaching or education, HFS and the role that the method plays in nursing education.

4.2 Discussion of the Findings in the Studies Reviewed

Most of the consulted studies have affirmed that HFS improves clinical skills, while the reviewed studies present key themes that are integral to understanding the full scope of the review topic. For example, the findings indicate the increased importance of HFS and how it can be combined with theory and practice for clinical efficiency (in gaining clinical skills). Also, the studies have outlined the importance of HFS in gaining and retaining technical skills among student nurses and this chapter provides a detailed explanation of how HFS improves clinical skills.

4.3 Using HFS and Theory to Practice to gain Technical Skills

Hall (2015)focused on three situations including postpartum haemorrhages, pregnancy-induced hypertension, and placental abruption. Hall (2015) reported high performance among the simulation group ($p<0.01$) in their improved response to postpartum haemorrhages, hypertension during pregnancy, and placental abruption. The results report that HFS is crucial in ensuring that students have been presented with excellent opportunities for engagement into applying their theoretical knowledge, and to help with knowledge transfer that can be transformed into practical skills, and hence, the improvement of critical thinking capacities or abilities among student nurses.

4.3.1 HFS and Critical Thinking Skills

The studies have profound implications for the present review, as they confirm HFS's efficiency in improving practical and critical thinking skills among student nurses. Specifically, the findings by Hall (2015) support other existing studies, such as Lindsey and Jenkins (2013), who argue that HFS support students in developing clinical judgment, as it improves knowledge retention, as well as clinical decision making; together with the assertion by Weaver (2011) on how HFS involves the implementation of realistic and patient-simulated patients environments. Likewise, the findings from this review inform that investigations into HFS are justified, as it is an area of contemplation facing or challenging nursing educators (Smith-Stoner, 2009). Therefore, from the current review and the existing studies, it isapparent that HFS should be a major area of investment in nursing education, due to the profound benefits to students in improving their clinical skills, such as clinical judgement due to enhanced knowledge retention through realistic and experiential learning (Hall, 2015).

4.3.2 Inter-professional HFS and Effective Communication and Teamwork in Developing Technical Skills

Kirkham (2018) focused on inter-professional simulation training and how it is useful to enhance nursing students' performances regarding clinical skills. One area of simulation being explored and discussed is inter-professional working, especially the role that simulation plays in improving this experience. From the current study, inter-professional working has been discussed from the perspective of effective communication and teamwork as necessary in the avoidance of preventable human clinical errors, which are always attributed to patient injuries, or in extreme instances, death. Non-technical skills include how students exhibit active communication and inter-professional team-working skills, which show their situational awareness and understanding when it is necessary to call for assistance and undertake structured SBAR (situation, background, action and recommendation) (Kirkham, 2018). All are supported by existing literature, which showsthat nursing professionals have redirected their efforts towards devising innovative or technology-based nursing education and teaching techniques that will less render patients to preventative mistakes (Lindsey & Jenkins, 2013). The findings from this review similarly resonate with the assertion by Smith-Stoner (2009), who mentioned the concern regarding the lack of clinical experience in nursing education made available to student nurses as a way of enabling them apply the learned theory into practice. Therefore, this review confirms the existing evidence on how simulation-based teaching is crucial for transferring theory into practice through realistic simulation, and thus, it is crucial in avoiding and addressing preventable human errors, as students learn gradually and rectify their mistakes without putting patients' lives in danger.

4.3.3 Inter-Professional HFS, Effective Communication, Technical Skills and Patient Safety

Simulation, when combined with debriefing, is crucial in promoting and safeguarding patient safety (Kirkham, 2018). The author also indicated that inter-professional simulation enhances the ability of nursing students to find a suitable environment, while making sure that appropriate equipment is available, as simulation entails designing extremely useful scenarios that are vital in meeting the students' learning outcomes. Moreover, from simulation, inquiry and advocacy are essential, as they are crucial in aiding students with experience understanding and reflection.

The benefits of inter-professional simulation have been mentioned by other researchers, who show how HFS in nursing education improves social and cognitive skills to complement technical skills in nursing (Lewis et al., 2012).Inter-professional simulation is majorly crucial in developing non-technical skills, which is necessary in interaction and relationship development, alongside critical thinking, such as the ability to read, comprehend situations and make decisions to aid in the execution of tasks (Lewis et al., 2012). Furthermore, high-fidelity inter-professional simulation improves sociability, interactions, relationship development, and effective communication, which are equally necessary and crucial for students to develop confidence, ask for help and improve their clinical judgment or decision-making skills. Improved clinical judgment or critical judgment when students have been taught through inter-professional HFS is positively associated with patient outcomes when confronted with complex care management scenarios (Hall, 2015).

Scholes et al. (2012), as one of the consulted studies in this review indicates that HFS improves the capacity of students to recognise andto respond to deteriorating conditions, or to make timely requests to acquire

assistance and increase their calls for assistance from senior or advanced nurses. Hence, HFS helps to address the challenges faced by students in prioritising their actions in scenarios that call for various responses. In addition, HFS is part of mnemonics, which students explore as the heuristic devices for guiding their actions. Through HFS simulation, students are able to introduce novel imaginary concepts against which they confirm or disprove a judgement, thereby eliminating complex faults. The findings by Scholes et al. (2012) resonate with Lewis et al. (2012) who note that few errors in patient care are a strong indication that these could be related to both technical and non-technical skills that are lacking among healthcare professionals or caregivers.

The findings of the study also support the assertion or inference, or how simulation-based learning, improves both technical skills, especially for students to perform injections, dressings, and flushing nasogastric tube (Lewis et al., 2012). Meanwhile, this confirms the earlier findings and explorations that simulation-based education, particularly HFS improves non-technical skills, including interpersonal communication, decision making, leadership and teamwork, of which the overall outcomes are viewed with the improved behaviours of healthcare teams in various clinical contexts or settings (Sanko, 2017). For example, as this review reports that HFS improves students' timely responses to emergency situations by asking for help, it shows how the education intervention improves their clinical judgment, which informs them that the situation requires advanced skills and intervention; hence, this calls for help from experts.

4.4 HFS, Self-Confidence and Development of Technical Skills

The current review equally aligns with the previous or earlier studies that indicate how simulation-based learning enhances self-efficacy development and improves the confidence of student nurses and specific nursing professionals regarding their clinical competencies and abilities (Norman, 2012). Accordingly, Scholes et al. (2012) reports improved self-confidence in emergency rooms, as well as the reduction in anxiety when handling extremely complex situations, such as in emergency situations. Therefore, the current review affirms the effectiveness of HFS as one of the pedagogical approaches which is more appropriate than traditional classroom learning. This is also supported by Ebrahimi et al. (2016), who indicate that for students who were assessed on imitation-based teaching, critical thinking improved.

For Chen, Grierson and Norman (2015), HFS is closer to reality, whose benefits are seen with the motivation of students towards learning, whereby students perform better, as they can transfer the knowledge to real health care management contexts. However, Chen et al. (2015) reported different findings regarding the effectiveness of the two methods. Nonetheless, this is a study that challenges that HFS and LFS do not have any differences in the improvement or enhancement of clinical skills among student nurses (Sanko, 2017; Norman, 2012). For example, the authors concluded that the LF instruction group may report improved auscultation examination outcomes in comparison to the HF instruction group. Conversely, the study (as part of this review) seems to challenge this. Specifically, HF was based on limited empirical evidence by Baddeley and Godden, of which researchers accuse them of basing their evidence of memorisation of random word lists underwater and on land, where the task has become out-dated in the contemporary clinical context. An insight from the review findings is that HFS has minimal advantages over LFS; therefore, there is a call for nursing educators to consider it as a model for teaching students.

Despite the challenge of HFS being effective, Chen et al. (2015) support that concern over the complexity of modern healthcare management, which compels the necessity for nursing students to be familiar with actual care or patient management scenarios or situations (Huiqin et al., 2012). Therefore, the study equally supports the recommendation that HFS technology helps nursing faculties to produce accurate clinical scenarios, which enable active education without threatening patients' safety, as students review specific errors (Richardson et al., 2014).

Comparatively, the current review has identified research insinuating that for both HFS and LFS, the students always demonstrate better performances in comparison to those who have been trained using traditional methods or approaches to learning theory-based classroom teaching. Chen et al. (2015) reports the differences in HFS and LFS is due to the nature of the experiment or variables being tested, as they tested for sounds which could be better learned through LFS. Overall, there is a positive indication that HFS improves the retention of technical skills, such as learning about cardiovascular sounds. There is much support from the current review on the effectiveness of HFS, especially on the notion that empowered learning through HFS is because the model provides broader learning areas; hence, this enables students to extend their knowledge (Dunbar-Reid et al., 2011). For example, the broader learning area in this review, as identified by Chen et al. (2015), includes the learning of cardiovascular sounds which improve students' technical skills in reviewing situations, alongside diagnosing and recommending or preparing a treatment plan of action which resonates with a patient's condition. Consequently, the present review has affirmed that simulation promotes didactic learning and students' knowledge acquisition is enhanced, while retention is prolonged in comparison to traditional lecture teaching (Huiqin et al., 2012). Therefore, this review confirms that HFS improves knowledge retention in both technical and non-technical areas of nursing education (Gray et al., 2012; Hall, 2015; Dunbar-Reid et al., 2011).

HFS helps learners to ascertain distinctive cooperative learning experiences in harmless and meticulous environments, of which learners can exercise without worrying about the impending harm to patients (Aqel & Ahmad, 2014). Irrespective of the overreliance on traditional classroom teaching as the sole method for providing clinical knowledge, this review reports that simulation (of which HFS is included) presents more extensive opportunities for experimental learning, which aids in the enhancement of knowledge retention and improves skills among students (Norman, 2012; Kirkham, 2018). In addition, this review has noted that, even though there are intrinsic advantages from traditional teaching, for example clarification of familiar concepts, when they have been used alongside simulated and interactive learning, there is greater enhancement of students' knowledge. For example, Aqel and Ahmad (2014) report how HFS helps to improve the retention of cardiovascular resuscitation skills and knowledge, while one of the reports from this study is that nursing students have a positive value towards simulation-based learning. The students perceive HFS to be effective as replications of real contexts, and thus, are essential in increasing or improving their confidence or ability when performing CPR. Therefore, this review affirmed that HFS is valuable, as it helps develop learning of psychomotor skills, along with enhanced skills of critical thinking.

The results from this review indicate that HFS is crucial in addressing challenges that students experience when attending to critical care patients; for example, patients' experiencing discomfort when on the verge of dying (Smith-Stoner, 2009). HFS plays the role of a simulator that bridges the gap to address fears of complex situations, such as caring for dying patients and developing necessary skills to facilitate meaningful death experiences for families. Consequently, as Aqel and Ahmad (2014) mentions in the case of CPR, HFS improves confidence among student nurses and helps them to develop the courage to address and attend to complex situations. Furthermore, the findings from this review support the assumption by Smith-Stoner (2009) that, despite HFS having technical complexities, is broadens students' knowledge and experiences. Therefore, HFS simulation is crucial and necessary to develop and improve the confidence of students in attending to complex and complicated situations as a non-technical skill. Hence, the review confirms previous studies that have called for substantial emphasis upon HFS to redress any challenges and concerns over issues and concerns, such as student nurses experiencing discomfort when attending to complex and critical care situations as a way of improving quality in the delivery of health care services.

HFS's effectiveness has been evident by how it has been used to address the exponential growth in nursing knowledge, and the challenges of dealing with few sites for nursing education or clinical sites (Curl et al., 2016). Moreover, it has been shown that by creating clinical sites for learning, HFS helps to address the problems of low admission rates in areas where clinical or nursing education and training resources are limited. Therefore, HFS as a model for education helps nursing educators to increase their programmes through the requirement to collaborate and share clinical resources, of which innovative strategies, such as HFS have been recommended as feasible and effective. Indeed, this review has ascertained, through Curl et al. (2016), that HFS, if correctly implemented, provides clinical experiences within real clinical settings to address the shortage for education or clinical practical sites, while instilling better knowledge than those students who are only taught using traditional clinical experiences or theory-based classroom teaching; this is also supported by Lewis et al. (2012); Pauly-O'Neill and Prion (2013).

4.5 Findings and Applications of the Review

The current SR summarises the findings from the authors that HFS can be an effective strategy in education and can be used alongside traditional clinical experiences or integrated into the curriculum. In this case, there is a focus for an integrated approach to nursing education, of which traditional and HFS teaching methods are used concurrently to enhance student knowledge retention and skills' development. However, a major recommendation when implementing HFS, from this review, is how Curl et al. (2016); Pauly-O'Neill and Prion (2013) suggest that the effectiveness of the simulation modules can only be assessed when pre-lab activities are introduced to establish a student's baseline knowledge. Therefore, for HFS to become effective there is a requirement to understand the baseline knowledge of the students and to use the knowledge gap in training students by utilising the simulated environment on technical and non-technical skills. Comparatively, others argue that the effectiveness of HSF would be augmented when pre-lab activities and debriefing have been included as part of the learning process. In this case, the effectiveness and efficacy of HSF in improving knowledge and skills among student nurses is one of the solutions for expanding faculty resources and equipment, especially how Curl et al. (2016) calls for collaboration in developing simulation labs.

Previous studies support the conclusions by Curl et al. (2016) on the effectiveness of HFS in the enhancement of skills and competencies among student nurses. For example, Lewis et al. (2012) noted that HFS enhances clinical decision making by empowering students towards increased knowledge retention by reducing the anxiety of clinical practices. Specifically, anxiety is one of the reasons why human errors occur and are all attributed to student nurses who have not become accustomed to or used to real clinical management situations (Pauly-O'Neill & Prion, 2013). Therefore, HFS is a way of prior exposure to real clinical situations, where

students address the anxieties and worries that they have in relation to care management, especially high complex situations. Even though there is the challenge of anxiety among students, especially those who have not been accustomed to or gotten used to complex HFS technologies or simulated environments, Lewis et al. (2012) equally supports Curl et al. (2016) on the efficacy of HFS in increasing the overall confidence among students, and therefore, an indication of how HFS should be appreciated and recognised as the best solutions to rectify student anxiety, confidence issues, and challenges with complexity care management situations.

In regards to HFS, when assisting students to gain confidence as a non-technical skill, it has been reported that the model of teaching aids students to gain perspective regarding the role of the qualified nurse (Traynor et al., 2010). Consequently, an essential method or approach is necessary to reduce the adverse nursing events, such as the compromise of patient safety. In addition, through HFS, confidence and efficacy are gained, as students develop comprehensive understanding of how theory relates to practice. HFS brings the practical aspect of learning and also provides the clinical or simulated environment to transfer theory into practice, which equally aids in developing confidence, self-efficacy, as well as the competence of student nurses. Accordingly, students have ascertained that they have positive attitude and regard towards HFS, as through this model, they have the opportunities to identify the gaps in their knowledge. Whilst simultaneously providing confidence for success in future clinical practice. Overall, HFS not only provides students with the confidence within clinical practice, but also assures them of success in their future real work contexts. It bridges the disparity concerning theory and real life practice and develops learners to become prepared to face real clinical management scenarios.

The role that HFS presents in improving skills and knowledge among student nurses can be assessed and reviewed from the manner in which it enhances and improves their efficacy in medication administration; Pauly-O'Neill and Prion (2013) argued that medication administration is the major role of professional nurses. As a consequence, medical nurses are often primary targets of medication errors or prescription mistake deterrence efforts. For instance, Levinson (2010) described that prescription errors are attributed to numerous adverse events in care management facilities. Due to this concern, simulation methods, when compared to traditional methods, are exclusively the most effective method for teaching and learning about medication calculations, in addition to improving the abilities that BSN student nurses have in administering medication.

Pauly-O'Neill and Prion (2013) report the essentiality of simulation methods in improving BSN understanding and performance on MAE. In addition, the methods have been indicated and confirmed to augment the understanding of vital nursing concepts among students, both clinical and didactic areas of clinical or nursing education. Besides, Pauly-O'Neill and Prion (2013) imply that simulation methods should be considered and reconceptualised in nursing education by the nursing faculty, not merely for teaching tools within clinical situations, but also used by a larger number of students for a multitude of nursing education-related issues, such as medication administration. In accordance, various scholars are also in support of the use of simulation learning or teaching to improve technical skills among nurses. Sanko (2017) contributes to this debate by identifying how technical skills, such as the performance of injections, are improved through HSF. Likewise, Norman (2012) confirms the inference of other scholars by noting that HFS generally leads to the enhancement of self-efficacy, which is crucial in the development of technical skills among student nurses.

Therefore, from this review, it can be deduced that technical skills are imperative, such as the calculation of medication, which include the quantities, amounts and the frequency of administration. HFS has also been shown, from this review, to be the only way that student nurses can reduce and fix human errors associated with wrong medication. Hence, there is confirmation and justification that HFS should be considered as the best teaching method for training students in regards to medical administration, as Pauly-O'Neill and Prion (2013) noted that for the HFS intervention group, they passed their medical administration tests.

4.3 Review Limitations

One of the limitations of the review concerns the reliability of a SR, especially in relation to the studies included, as based on their methodologies. For example, the majority were quasi-experiments, which Kirkham (2018) stateshave a lack of random sampling, and hence, limit the opportunity to generalise the findings. Furthermore, the language restricted the present study to only English published studies, and therefore, better potential studies could have been missed in other languages. Also, there was publication bias, due to the confined and restricted year range of2008-2018.

4.4 Summary

This chapter concludes that HFS improves and increases the learning capacity among students, as they engage in learning through acting in real situations. In addition, it improves crucial elements and aspects of learning, such as communication in the provision of care with doctors, teams and relatives. Moreover, HFS helps with the understanding and comprehension of nursing care and interventions which are provided, which gives priority to specific care management practices, relating the learning theory to practice, and augmenting

skills or knowledge within a specific area of study or case. Some studies have identified the essentiality of debriefing sessions, which are part of HFS teaching and are perceived by students to be greatly helpful and beneficial. Debriefing is a crucial aspect of student learning, especially in role-plays, as during this phase the students are able to learn more about their input regarding their improvement. HFS introduces students to new concepts and the safe simulated environment aids learners to relate and transfer knowledge into real world contexts. HFS is also based on real-time feedback that helps students to identify their mistakes, correct errors and also not worry about harming patients; therefore, reducing human errors, which are responsible for adverse nursing events.

IV. Conclusion

5.1 Introduction

HFS improves and increases the learning capacity among students by learning through acting in real situations. It has found its use in nursing education, and draws research attention on how HFS improves technical skills among student nurses. This chapter summarises the significant insinuations for healthcare organisations. It specifically summarises the review findings, explains the suggestions for practice, and recommends directions for future exploration.

5.2 Implications for Practice

ThisSR has presented evidence supporting the effectiveness of HFS in improving clinical skills. Therefore, it can serve as a reference for evidence-based practices or interventionsto improve clinical skills among undergraduate student nurses. The KSA requires a change and a newer approach to teaching clinical skills and implementing HFS as one of the emerging areas of nursing training. The review asserts that HFS improves technical skills among nursing students, and hence, should be adopted to support evidence-based practices on how to improve technical skills in nursing.

5.3 Directions for Future Research

From the identified and discussed articles, HFS has been reported and approved to improve clinical skills. However, there is the inherent necessity to make considerations for future research directions. One of the conclusions that emerge from this review is that HFS, when used alone, contributes to greater knowledge retention and skill development among student nurses. In comparison, other studies have indicated that there are better outcomes when HFS is used alongside traditional teaching or an integration of the two methods. Therefore, there is the inherent necessity for future research to focus on the identification of the best method; whether stand-alone HFS teaching is most effective or whether it should be combined with traditional teaching method of classroom theory-based learning for improved effectiveness. Conversely, it is not clear whether standard simulations or manikins could be the most effective with nursing students. Therefore, future research direction should focus on comparing the effectiveness of manikin or standard simulations and provide direction on which method or approach should be adopted in nursing education as the best and most effective in teaching clinical skills. Furthermore, there is a requirement to clarify whether HFS and LFS provide the same benefits or outcomes, as some studies have not found the differences in using the two approaches or simulation methods. Therefore, future research should focus on measuring the same variables, asHFS is an area which continues to attract scholarly attention as a recent innovation (approximately a decade) in nursing education.

5.4 Summary

This chapter concludes that HFS improves the learning capacity among students and engages themto learning through acting within real situations. Simulation has higher effectiveness for student learning, as it is directed towards providing real situations. Simulated environments are based on imitations of real clinical situations, and thus, provide students with realistic learning. The need to engage in simulation-based learning or teachings is based on how various issues within the nursing profession have evoked a renewed effort towards the identification and innovation of the best alternatives to improve nursing skills, in order to avoid preventable human errors.

This review was directed by the concern over the probable dangers that occur to patients when HFS is utilised in learning during their hospital stays (Lewis et al., 2012). Hence, HFS provides realistic clinical situations, whereby individual nursing students use manikins for realistic learning and do not requireexposure to real or human patients when they are not fully prepared, due to the inherent dangers they pose to these patients due to limited or a lack of clinical experience. The concerns over human or preventable errors have forced nursing professionals to redirect their efforts towards devising innovative or technology-based nursing education and training methods that will less expose patients to preventative errors (Lindsey &Jenkins, 2013). In particular, HFS was introduced due to the concern regarding the lack of clinical experience in nursing education that was made available to student nurses as a way to enable individuals to apply learned theory into practice

during practice hours for students. As a result, the need for HFS stems from students lacking clinical experience, knowledge and skills responsible for the adverse events or preventable human errors during care management.

From the current review, it has been determined that HFS is effective in improving all aspects of technical clinical skills, such as how individuals engage with doctors in complex care management situations. Specifically, there are inter-professional simulated situations or scenarios,where student nurses are exposed to teamwork and the collaborative learning helps in learning technical skillsthrough experience and observation. One of the areas explored in this review was the requirement for student nurses to ask for help or advocate for help in emergency management situations.

Through enhanced critical thinking, judgment and clinical decision making, individual nursing students improve their confidence, as they have the belief and notion that they are capable of making the right decisions, arriving at the right course of action, and subsequently, devising the best solutions for the presented problem. Hence, HFS, as shown from the current study, is highly effective in improving overall belief levels in one's-self to address and confront complex healthcare management situations; thus, it is necessary to reinforce technical clinical skills. It is also through HFS that students can assess themselves and ascertain whether they are ready and have the confidence required for a complex healthcare system.

Another aspect of HFS is that it improves and increases knowledge retention among learners. HFS is based on simulated learning, whereby students are exposed to real life contexts and conceptualisations, where they develop abstract meanings and also get provided them with real or practical opportunities or learning environment to implement the learned concepts. Therefore, knowledge retention is specifically useful in the development of technical skills that require mastery. Particularly, in repeated simulation, students gain the opportunity to stress the concepts being taught, which improves memory retention. The retention of the knowledge and skills is further augmented through the emphasis of HFS in practical learning, as opposed to theory-based learning. Moreover, HFS helps with the understanding and comprehension of nursing care and interventions, which are provided and give priority to specific care management practices, relating the learning theory to practice, as well as augment skills or knowledge within a specific area of study or case. Nursing care interventions are some of the technical and complex areas of care management that require detailed knowledge. However, it is not easy to teach these skills and knowledge through traditional theory-based learning. Instead, HFS helps students to transfer the learned theories into real scenarios.

In addition, the current review has identified the essentiality of debriefing sessions, which are part of HFS teaching, and are perceived by students to bean imperative practice. Debriefing is a crucial aspect of student learning, particularly in role-plays, as it is during this phase that the students are able to learn more about their input regarding their improvement. HFS introduces students to new concepts and the safe simulated environment aids the learners to relate and transfer knowledge into real world contexts. HFS is also based on real-time feedback, which helps students to identify their mistakes, correct errors and not to worry about harming patients. This, therefore, reduces human errors, which are responsible for adverse nursing events. In so doing, the unique aspects of HFS, such as real-time feedback and debriefing, help toemphasise the learned concepts, which is essential in learning certain technical skills. For instance, in the current review, it has been noted that HFS is effective in improving medicine administration among student nurses; hence, it is associated with positive outcomes of medicine administration exams. In general, HFS improves the inherent technical skills among students and should be valued as a unique innovation in nursing education.

5.5 Recommendations

There are various recommendations that should be taken into consideration when implementing HFS. In developing countries, such as the KSA, classroom teaching is still crucial. Therefore, the HFS model should be gradually introduced alongside traditional teaching, as a combination of the methods has been proven to be effective and useful in improving clinical skills and knowledge among students. It is also vital for policy makers to ensure that HFS becomes part of nursing education. In accordance, policy makers should be at the forefront in supporting nursing faculties to implement HFS models. Furthermore, as shown from this review, HFS is the best, as they can be programmed to match the physiological context of nursing education. Therefore, instead of the standard simulations, manikins should be preferred, as they bring about the best outcomes in terms of improving knowledge and clinical skills among students. Moreover, an integrated approach or framework should be preferred, as traditional classroom teaching is not obsolete, but actually crucial in learning familiar concepts, whilst also a platform for bridging the gap between theory and practice. It is in the best interest of the students that education policy makers should fund research that is necessary to develop the most beneficial HFS models or approaches to teach students, due to ever changing technology. In addition, teachers should be included in the design and development of HFS, as they understand how students learn, their knowledge gaps, and the necessary areas to be covered within simulated environments.

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