Efficacy of simulation practice to improve confidence and knowledge in clinical skills of adult critical care nurses:

Nazeeh Sharaf Alsayali

Programme of Study: MSc in Nursing: Education - Full Time

Abstract

Background: *Understanding the efficacy of simulation is critical for nurses in the modern healthcare profession, where the level of competence and safe care is essential. The diverse field of medical practice has understood the efficacy of simulation practice, but not in the field of adult critical care*

Objective: *To determine if the use of simulation practice improves confidence and knowledge in the clinical skills of adult critical care nurses*

Methods: *The study used a systematic review of the available literature. The literature comprised 15 studies, which were selected through pre-defined inclusion and exclusion criteria. This review discusses the quality of the studies and provides a critical appraisal of the methods to help in answering the research question. Different themes emerged from the different studies in relation to the efficacy of simulation practice and its improvement of confidence as well as knowledge of clinical skills in adult critical care nurses.*

Findings: *Simulation practice facilitates the demonstration of confidence as well as knowledge of the clinical skills for adult critical care. However, this review shows the need for healthcare institutions to adopt collaboration, communication, teamwork, and overall performance- oriented input for the simulation to improve confidence and knowledge of clinical skills among adult critical care nurses.*

Conclusion: *Simulation learning is intended to facilitate skill acquisition by shifting attention from the ineffective traditional channels of teaching. Improvements in confidence and knowledge among nurses occurred due to the understanding of patient management issues acquired through the use of simulated critical care skills to deal with complex situations.*

Date of Submission: 06-11-2022   Date of Acceptance: 20-11-2022

I. Introduction

Overview

Simulation refers to an education strategy or practical learning experience meant to equip the students with wide-ranging clinical scenarios that could be encountered in real nursing care (Aggarwal et al., 2010). The challenges in healthcare workplaces demand students' acquisition of essential practical skills to promote optimum patient care. Conversely, critical care entails specialised patient care for life-threatening conditions (Husebø, O'Regan, and Nestel, 2015). The patient requires comprehensive care and regular monitoring in the intensive care unit. This systematic review will involve discussion from the perspective of the whole-world context.

Simulation practice has become an integral part of the nursing profession. Understanding the efficacy of simulation practice within the field of nursing practice would help in ascertaining its strategic role. In an era where optimum patient care has become a priority, nurses or healthcare institutions have to settle on the applications or practices that meet quality expectations (Blackburn, 2014). The demand for quality healthcare requires simulation practice, which recreates scenarios while testing the capability of the practitioners in handling challenging medical situations. Brady, Malone and Fleming (2009) assessed diverse nursing literature and found the need for use of simulation mechanisms to enhance nursing management as well as in reducing individual or system issues such as poor drug distribution systems.

Sellman, Snelling and Sellman (2016) support the view that a systematic review of simulation practice could change the way nurses approach adult care based on experiential learning during training. Although the practice inclines towards nursing education, with the ultimate aim being quality patient outcomes, this review will address research as well as practice-based gaps where these impede achievement of patient safety. Husebø et al. (2015) agree that the evolution of instructional strategies is critical for nurses in practice. This review will ascertain the relevance and efficacy of simulation practice but within the field of adult critical care.

Understanding the efficacy of simulation is critical for nurses in the modern healthcare profession where levels of competence and safe care are a top priority. Simulation enhances the provision of care by ensuring that nurses familiarise themselves with diverse patient concerns. For example, Jones and Potter (2017) report that all Critical Care Response Teams in Ontario hospitals utilise skills relating to cardiac or respiratory

---

training learned through simulation lessons. Aggarwal et al. (2010) acknowledged the growing role of simulation but limited their focus to patient care as opposed to nursing practice. The focus has been nursing care in which health professionals interact with simulation materials such as interactive manikin simulators, task trainers, virtual patients, and screen or computer-based simulations. According to Blackburn (2014), simulation practice offers a platform for improving system performance and overcoming the inexperience of the nursing practitioners.

United Kingdom (UK) hospitals have adopted simulation practice with the aim of improving medical procedures but also based on the compelling need to improve the quality of patient care. A review by Husebø et al. (2015) found simulation practice as an integral building block of reflective practice but limited their focus to simulation-based education. Simulation-based education is applied to student nurses' in learning institutions rather than nurses in practice, as postulated by Blackburn (2014). Nonetheless, the analysis affirms the adoption of simulation practice within nursing, but the focus has been the patients rather than the experience of nurses. Generally, the diverse field of medical practice has understood the efficacy of simulation practice. Aydin, Ahmed, Shafi, Khan & Dasgupta (2016) acknowledge simulation practice as part of the urological training that enhanced the capabilities of 23% of specialists. Blackburn (2014) believes that the next generation of endoscopists will require simulation practice in training to enhance nursing care delivery in the department. Despite those diverse authors showing the increasing role and influence of simulation practice, none has shown the connection between simulation and confidence or knowledge of clinical skills among adult critical care nurses.

Background/Context
Adoption of Simulation Practice

Simulation practice has gained prominence in the field of critical care nursing. Educators and health professionals have sought ways to induce quality service delivery for patients in emergency situations or needing optimum care within the health institutions (Staudinger, Hoess & Ostermann, 2009). Medical administration systems have to accommodate simulation systems to achieve effectiveness and efficiency: particularly in an era where patients are expecting quality nursing care. Baillie and Curzio (2009) find that the UK has been one of the leading nations in enhancing students' and subsequent nursing or clinical competence. An evaluation project involving 267 nurses revealed the growing importance of using simulation practice to assess the influence of simulation programmes. The project showed significant incorporation of simulation to promote effective adoption of skills during placement periods.

The primary objective of acknowledging simulation practice is to expand the influence of traditional methods, which researchers have associated with shortfalls relating to quality patient outcomes. Although the global status of simulation practice involves its use in the experiential learning environment (Staudinger et al., 2009), it is imperative to understand the efficiency of the concept within real life adult critical nursing care. Simulation practice is growing at an exponential rate across the globe within healthcare organisations. According to Qayumi et al. (2014), licensing and accreditation have understood the connection between quality patient outcomes and simulation practice.

Researchers have limited their focus to experiential learning and curricular integration of simulation practice rather than assessing or surveying whether the approach has implications for nursing practice. Although varied levels of simulation practice influence the efficiency of nursing practice, adoption varies from one country to another. Countries such as the United States, Canada, and Saudi Arabia have embraced simulation to confront deaths and errors that occur during admissions, treatment, and surgical procedures. For example, Al-Elq (2010) found that American teaching hospitals considered changing their instructional methods due to 13.6%death rate and costs estimated at $2.8million annually.

Limited Research on Simulation-Based Nursing Education

Research by Tiffen, Graf, and Corbridge (2009) on clinical simulation in nursing education assessed the principles needed to equip the students to improve their self-efficacy during the pre-licensure programme. The research highlighted the need for the students to acquire skills that would expedite optimum service delivery during nursing practice. Although the research pointed towards a practice or instructional method that underlines clinical judgment, communication, and confidence, it did not affirm the efficacy needed to improve critical care for adults. The analysis of 112 students by Tiffen et al. (2009) is one of the existing assessments which has only managed to popularise the influence of simulation within the field of nursing education rather than showing its influence in real nursing care settings.

The efficacy of simulation-based nursing education has been the focus of literature review researchers. Neill and Wotton (2011) understood high-fidelity simulation as an important instructional method for nursing student engagement. Their review of the literature found significant investment into the integration of simulation within the nursing education process to follow the experiential learning philosophy, while enabling students to

develop as well as refine their knowledge and skills. The assessment of the literature on debriefing students offers a platform where simulation scenarios can be assessed from the perspective of evidence-based learning. Although the analysis by Neill and Wotton (2011) found a significant influence of simulation education, a review of the various literature on simulation debriefing scenarios did not show the extent to which it could create efficacy during practice.

According to Brewer (2011), the adoption of simulation techniques has increased over the years to accommodate the changing needs and expectations of patients. Students have to undergo thorough preparation through which they can acquire much-needed skills and reduce overreliance on the traditional experiential learning methods. Brewer (2011) undertook a review of the literature with the aim of exploring the techniques deployed to expedite human simulation exercises. However, the review sought to assess the efficacy of human patient simulation within the field of nursing education rather than affirm how the instructional method could be a superior way of influencing critical care nursing. Brewer (2011) found that experiential learning was effective in equipping nursing students with skills, but the focus on its influence on nursing curriculum did not contribute to the discourse on simulation practice in nursing practice. Jones and Potter (2017) found that Critical Care Response Teams in Ontario focused on the successful use of simulation skills to reduce patient death. The study demonstrated actual application of simulation practice.

Hayden (2010) carried out a national survey on the utilisation of simulation in nursing education, guided by the increasing use of the methods in nursing schools. The research pointed towards an education process that accommodates new technology to improve the acquisition of skills for nursing students. The research aimed to offer the analytical perspective of National Council of States Boards in the U.S to describe the role of simulation comprehensively. Although Hayden (2010) assessed 1060 pre-licensure programmes, affirming the effectiveness of simulation was not enough. There should have been a connection between the skills acquired during the educational process and their application in nursing practice. For example, the use of skills could reduce the 40% mortality rates in respiratory departments as reported by Villar, Sulemanji and Kacmarek (2014). The concept of adult critical care require research-based affirmed of how the efficacy of simulation practice could improve confidence and knowledgein clinical skills among nurses.

Simulation Practice for Adult Critical Nursing Care

UK has been one of the leading promoters of simulation practice due to the increased need for effective adult critical care. Cronin, Nielsen, Spollen, and Edwards (2010) prepared a report on adult critical care to understand how the demand for quality health has changed over time. According to Staudinger et al. (2009), the influence of the use of simulation is due to the quality needed within departments such as critical care, which varies according to age as well as gender. Another report by the NHS (2012) showed that efficacy of nursing practice is essential considering the rise in cases of medical errors between 2008 and 2011. Although nurses within the UK have undergone significant training and experiential learning, the statistics affirm alarming rates of cardiac and coronary conditions. The report further showed increasing critical care incidences, which averaged 8.7% at weekends. The diverse incidents in adult critical care demand a demonstration of how effectively the use of simulation could influence the clinical skills of nurses stationed in different departments. The occurrences in UK intensive care units (ICUs) and high dependency units (HDUs) might not be representative due to the varying nature of critical care issues (Villar et al., 2014), but they affirm the reason why nurses must have sufficient clinical skills to meet increasing demand.

The Society of Critical Care Medicine (SCCM) (2017) emphasises the need to use medical experts such as nurses to address issues of critical care in the United States. The SCCM statistics show that critical care medicine costs have increased by 4.1%, which has further increased national health expenditure. The analysis was not categorical on the incorporation or consideration of simulation practice, but it showed how the achievement of the best possible outcomes for the critically ill patient is imperative. According to SCCM (2017), more than 5.7 million adult critical care patients require comprehensive management, including optimum nursing care. Simulation practice addresses quality improvement within the field of adult critical care nursing, which has received growing attention for impending national health budgets in countries such as the United State (US) and UK. According to Staudinger et al. (2009), every nursing practice technique must have quality implications and efficacy to ensurethat health institutions generate satisfactory patient outcomes.

Transferring Simulation Skills to Nursing Practice

The essence of assessing the efficacy of simulation practice in the process of improving clinicalskills is to affirm the extent to which nurses confront barriers when executing their skills. According to Newton, Billett, Jolly, and Ockerby (2009), barriers to acquiring health professional skills during clinical education exist. Newton et al. (2009) further assess the theory-practice gap that limits the ability of nurses in seeking to apply the skills learned in class. As postulated by Newton et al. (2009), going through the learning process is not a problem, but achieving the projected efficiency remains a cardinal issue. Simulation practices seek to evaluate the extent

to which improvement of clinical skills could influence the confidence andknowledge of nurses.

Scully (2011) views the theory-practice gap as an issue within the nursing education practice, which could limit skills acquisition. Simulation practice has received significant attention in recent years, but its application in critical care settings is an issue that needs systematic review. According to Scully (2011), matching skills learned through simulation with clinical situations is an on-going problem within the nursing profession. The theory-practice gap could explain the efficacy of simulation practice, where the primary agenda is to ascertain the chances of improving confidence and knowledge of clinical skills. The assessment of the theory-practice gap by Scully (2011) affirms that the development of competency is not guaranteed, but that it depends on the extent to which nurses are willing to execute the skills learned in class.

The current evidence further affirms simulation as the only method for preventing possible errors within nursing critical care units. Lewis, Strachan, and Smith (2012) undertook an assessment of simulation within the field of non-technical nursing skills to find fool-proof evidence on how high-fidelity simulation could address adverse events. The research demonstrated successful skills transfer from learning to nursing practice but could not affirm if indeed simulation skills could boost knowledge of clinical skills or the confidence of nurses. However, Lewis et al. (2012) view the practice as a non-technical skill that improves communication, decision-making, teamwork, and leadership. The findings incline towards current systematic reviews that give a minimal account of the efficacy of simulation in improving clinical abilities as well as the subsequent confidence of nurses in critical situations.

Potential Impact of this Review

A systematic review on the efficacy of simulation practice seeks to discuss patient safety within the field of adult nursing care (Kim, Park & Shin, 2016). Nursing errors might reduce following the establishment of a connection between simulation practice and the ability of nurses to administer adult care with confidence as well as knowledge of clinical skills. The primary objective of simulation practice is promoting effective and safe care for patients, but nurses have to undergo intensive education programs (Husebø et al., 2015). Nursing competence is a necessity for hospitals with adult care units in order to achieve the intended patient safety outcomes.

Connecting efficacy, simulation practice and knowledge and confidence among adult care nurses through a systematic review might address nursing errors such as in charting and documentation. Medical errors threaten the health and safety of patients, besides discounting the capability of nurses in achieving quality patient outcomes. According to Husebø et al. (2015), the execution of nursing skills determines the performance of nurses during adult care. The susceptibility to making errors, particularly in emergency situations, is high, but identifying simulation practice as an integral factor in preventing errors could change the delivery of care among nurses. Brady et al. (2009) find out that both system and individual issues such, as quality of prescriptions or deviation from procedures, could increase errors in nursing. However, analysis of implementing advanced mechanisms such as simulation could improve consistency and nursing management. Aggarwal et al. (2010) note that learning approaches such as simulation practice come to solidify medical practice by reducing mortality rates. For example, the study noted that the U.S was able to reduce by 98,000 the deaths that had occurred in the United States since the early 2000s.

This systematic review will further address the decision-making process of nurses offering adult care. According to Sellman et al. (2016), the management of errors, administration of medication and the ability to sustain quality in the healthcare profession depends on how well nurses understand the efficacy of simulation practice. The efficacy of simulation practice cannot be overlooked in nursing or the emergency environment because critical care is a priority in reducing the chances of death (Sellman et al., 2016). This review could establish the need to focus on the management of care among nurses providing adult emergency care services and the need to make decisions based on a level of realism. Although Kim et al. (2016) associate simulation practice with optimum decision-making, experiential learning offers a platform for critical thinking also. However, systematic reviews on the efficacy of simulation practice in adult critical care nursing remain scarce and undocumented.

Existing Reviews and Objective Systematic Evaluation

The review by McKinney, Cook, Wood, and Hatala (2012) sought literature from diverse medical journals including MEDLINE and CINAHL in a bid to establish a connection between simulation and cardiac auscultation skills. Although McKinney et al. (2012) found simulation- based training to have a significant influence on the effectiveness of the cardiac auscultation skills, it lacked sufficient published evidence to support the findings. The studies could have provided the basis for comparing and ascertaining the efficacy of simulation practice. Contrastingly, Scherer et al. (2007) adopted a practice-based approach to compare clinical simulation and case study presentation and their ability influence knowledge acquisition as well as the confidence of nurses during a cardiac event.

The study by Scherer et al. (2007) had a greater comparative effectiveness than McKinney et al. (2012) because of the need to assess the efficacy of simulation against another equally influential method. Scherer et al. (2007) found a similar effectiveness outcome on nurses' confidence and knowledge, but that cardiac event was not related to any adult critical care activity. The study further showed the minimal documentation of the efficacy of simulation practice among adult critical care nurses. Although another review by Hegland, Aarlie, Strømme, and Jamtvedt (2017) acknowledges the efficacy of simulation on nurses' skills and errors, it did not use quality or a sufficient sample size to affirm its findings.

Need for Further Systematic Review

Cementing the role of simulating practice in improving clinical skills and confidence is essential considering the extent to which adult critical care situations present challenges for nurses. Abe, Kawahara, Yamashina, and Tsuboi (2013) argue that simulation practice is known to influence the improvement of skills through repeated scenarios. However, focusing on discourse through the perspective of nursing education does not address the confidence and skills needed among adult critical care nurses. An in-depth and systematic review will suffice to affirm the ingrained role of simulation within nursing competency. The improvement of technical or non-technical skills is not enough, because the researchers do not show how it could improve the outcomes of adults in critical care units.

The current literature presents strong evidence of the influence of simulation practice on the skills or self-efficacy of nursing students. However, scholarly findings or documentation of simulation practice within the specific context of adult critical nursing care do not exist. The only landmark step made is the effectiveness of simulation-based learning for multidisciplinary critical care teams (Frengley et al., 2011). This systematic review will address the current gaps in research, as the research body has failed to affirm the efficacy of simulation practice in critical nursing care settings.

None of the existing systematic reviews addresses simulation practice and its effect on nurses' confidence and knowledge. A comprehensive systematic review will suffice to answer the following question:

Does the use of simulation practice improve confidence and knowledge in clinical skills of adult critical care nurses?
This review will pursue the following objectives:

1. To conduct a comprehensive systematic analysis of the efficacy of simulation practiceto establish if it improves confidence in using clinical skills of adult critical care nurses.
2. To assess the extent to which the efficacy of simulation practice improves knowledgeof clinical skills in adult critical care nurses.

II. METHODOLOGY

Overview
This chapter outlines the methodology used in the study. This section outlines the systematic review approach and the rationale for this review. The chapter further considers the merits and demerits of using systematic review in a bid to answer the research questions. The final section involves the search strategy used to gather journal articles and addresses the formulation of the research question.

Research Design
Description of Systematic Review
The study uses a systematic review approach to analyse existing studies. Systematic review aims to address a specific question in clinical or nursing research (Rebar and Macnee, 2010). However, gathering the relevant literature requires an explicit search strategy. According to Rebar and Macnee (2010), systematic review provides the foundation for evaluating the evidence found in the literature, which in turn facilitates answering the research questions. A rigorous approach is necessary for a systematic review because the aim is to answer the research question with minimal bias (LoBiondo-Wood & Haber, 2014). The process involved appraising and disseminating the results of the analysis of the studies, which then helped to answer the research question.

Rebar and Macnee (2010) argue that a systematic review encompasses analysis of published and unpublished studies. However, this study used published studies in the form of peer-reviewed journals. The studies boost the validity of the judgment made on the evidence emerging from the literature under review (Hulley, Cummings, Browner, Grady & Newman, 2013). The focus was on studies involving efficacy of simulation practice in the improvement of confidence and knowledge in the clinical skills of adult critical care nurses. Holly, Saimbert and Salmond (2012) reiterate the point that researchers depend on the methods utilised by other authors to frame research questions. The primary aim was to use the systematic review to analyse studies that would provide evidence relating to the topic under scrutiny.

The systematic review approach further allows compilation of the strongest evidence in clinical or nursing practice. The process collects Level 1 evidence from randomised controlled trials (RCTs) as well as evidence-based practice (Holly et al., 2012). The ultimate product is reliable and valid results that help to answer the research question. The focus of the study was to use all the evidence to conduct a comprehensive review of current knowledge on the efficacy of simulation practice in the field of critical care nursing (Egger, Smith & Altman, 2008). Systematic reviews ensure that the researcher looks for studies and analyses their results together (Holly et al., 2012). Moreover, systematic review plays an integral role in evidence- based practice.

In this review, the researcher will undertake a systematic review. However, because one researcher is going to carry out this review, it will be described as a systematised review (Grantand Booth, 2009).

Usefulness of Systematic Review in Evidence-Based Practice
Understanding the efficacy of simulation in improving knowledge of clinical skills and confidence in adult critical care nurses requires evidence that would enhance changes in that practice (Bronson & Davis, 2012). Systemic review plays a role in facilitating the synthesis of relevant study findings, which provides the best evidence. Consequently, a systematic review is a building block of Evidence-Based Practice (EBP), whose focus is to improve patient outcomes as well as the input of healthcare practitioners such as critical care nurses. Methodologically, Khan (2011) argues that systematic reviews offer the strongest data in EBP: particularly when compiled by a person with substantive expertise in the area. The study aimed to synthesise multiple studies with the aim of limiting the selection bias that comes with other research methodologies such as meta-analysis, which Hulley et al. (2013) term as a statistical technique for combining from different studies.

According to Ganeshkumar and Gopalakrishnan (2013), systematic research informs the decision-making of healthcare researchers, who then shape the values and expectations of patients in clinical practice. The study herein seeks to seal knowledge gaps with respect to the efficacy of simulation practice and its potential in improving confidence and knowledge of clinical skills among adult critical care nurses. Development of data categories was necessary if the primary studies used for the research were to yield any sufficient evidence to answer the research question (Khan, 2011; Bronson & Davis, 2012). However, the effectiveness of the systematic review in EBP requires consideration of the hierarchy of evidence. According to Hulley et al. (2013), hierarchy of evidence ranks study types based on the rigour of the researchmethods used (Figure 1).
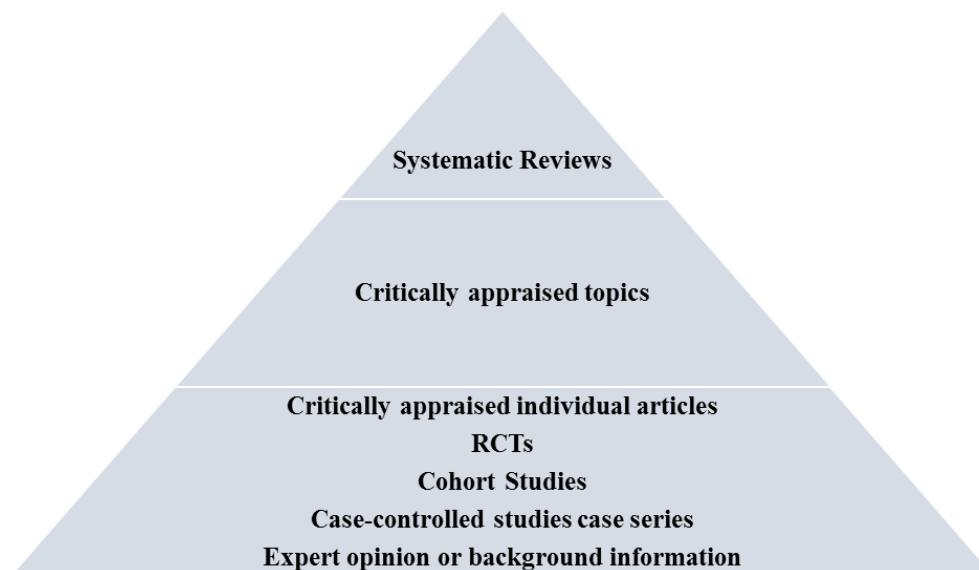

Systematic Reviews

Critically appraised topics

Critically appraised individual articles
RCTs
Cohort Studies
Case-controlled studies case series
Expert opinion or background information

Figure 1: Hierarchy of Evidence (Mallett, Hagen-Zanker, Slater & Duvendack, 2012)

The appraisal of the best available evidence is an integral part of EBP, which should becarried out in a systematic review. As recommended by Holly et al. (2012), systematic review

is the level 1 evidence that should enable a researcher to answer the main research question. Systematic reviews sit at the top of the hierarchy of evidence because they remain a rigorous methodology that maximises the validity of the study results (Ganeshkumar and Gopalakrishnan, 2013). Other levels of evidence, involving Cohort studies, case-controlled studies, and expert opinions lack rigorous methodologies due to unfiltered information (Bronson & Davis, 2012). Consequently, the approach has outstanding merits in research.

2.2.1.2 Merits of Systematic Review

Systematic reviews inform the decision-making of healthcare professions based on the evidence gathered from different primary studies (Mallett, Hagen-Zanker, Slater & Duvendack, 2012). The research aimed to assess the connection between the efficacy of simulation practice and the confidence as well as knowledge of clinical skills among adult critical care nurses. The evidence focuses on responding to the main research question. Rebar and Macnee (2010) insist that systematic review does not allow generalisability but promotes reliable results that healthcare professionals could use to make decisions or boost the outcomes of the study process.

Although the systematic review process offers a definitive answer, it also facilitates the application of findings within the practice. The researcher focuses on identifying the knowledge gaps that require additional research, which becomes the point of establishing reliable findings (Mallett et al., 2012). The study focused on affirming the influential role of simulation practice, considering its increased use within the nursing practice. The findings could ascertain why novice nurses might need simulation practice in their search for in-depth knowledge in clinical skills within the field of critical care.

Using a systematic approach allows the researcher to gather conclusions that are more reliable than findings from an individual study. According to Ganeshkumar and Gopalakrishnan (2013), a review eliminates the possibility of bias in research conclusions. The mathematical power of the review process is high, which helps in minimising bias when reaching conclusions. While reaching conclusions using systematic review is essential, the study deploys the method due to practical advantages, as cited by Rebar and Macnee (2010). Using primary studies for analysis demands less in terms of costs than carrying out primary research or carrying out tests to affirm the efficacy of simulation practice within the field of adult critical care nursing. However, systematic review facilitated the research process with its weaknesses in mind.

2.2.1.3. Weaknesses of Systematic Review

Rebar and Macnee (2010) argue that evaluation of the different studies could be time- consuming in the systematic review process. Answering the research question requires in-depth knowledge, which further necessitates the researcher to focus on the data provided by studies. In addition, the systematic review may create statistical misunderstanding, which could skew the validity of the results, as explained by Mallett et al. (2012).

The systematic analysis may require the use of unpublished and published studies, which could be hard to find from healthcare databases (Rudnicka & Owen, 2012). The published literature lacks representation, particularly when unpublished studies are used. The systematic review process requires the researcher to use a part of the existing studies, which could result in misrepresentation issues. Representative bias and unreliable evidence could reduce the accuracy of the results (LoBiondo-Wood & Haber, 2014). The study sought to use a sufficient number of studies drawn from diverse authors to mitigate the representation concern, which could affect the validity of the research findings.

Using published studies in the systematic review does not reduce publication bias: particularly when inconclusive results remain unpublished (Rudnicka & Owen, 2012). This bias could lead to exaggeration of results. The subjective nature of the researcher is an integral weakness of the systematic review. The study could suppress results to meet the purpose of the study, which furthers publication bias. However, the researcher sought to reduce publication bias by using the best evidence available, as recommended by Rebar and Macnee (2010). Minimal bias or inconclusive results helped to answer the research questions, which is a critical requirement of any EBP. The research aimed to present positive results that could affirm the efficacy of simulation practice in relation to the confidence or knowledge of clinical skills among critical care nurses.

2.2.1.4 Systematic Review Procedure

This systematic review process involves seven clear procedures, which were utilised in the study. The following is a brief description of each step as described by Cormack and Gerrish (2011).

Defining the research question

The researcher devises a research question that forms the basis of the research process. The question should be specific and show the primary aim of this review process.

Deciding which studies to include in this review process

This step required the researcher to focus on the eligibility of different studies. The research question defines what studies should be included or excluded. The studies must have a rigorous design.

Searching the studies
This step involves gathering the sources to be used in the study based on certain search terms defined by the researcher, but in line with the research question.

Selection of the studies and data collection
The researcher decides which data to use from the study based on predetermined eligibility criteria. The data can come in diverse formats based on the selected studies.
Assessing the risk of bias from the selected studies
This step facilitates analysis of the studies under review to affirm their relevance and reliability. The process helps to reduce bias and maximise the accuracy of the results.
Data analysis
The analysis of the data gathered from the primary studies undergoes extensive synthesis. This step is the core part of the systemic review
Presenting the Final Results

The researcher tables the summary of findings, which can be published or remain unpublished.

Search Strategy
The search strategy facilitated the process of searching and selecting studies in line with the research question. This systematic review focused on the following research question;
"Does the use of simulation practice improve confidence and knowledge in clinical skills of adult critical care nurses?"
Jonker and Pennink (2010) argue that developing a sound research question is critical for the systematic review process. This review focuses on answering a specific question within clinical practice (Khan, 2011). The research question guided the search strategy. The PICO frameworkfacilitated the formulation of the research question.

The PICO framework
PICO (Population, Intervention, Comparison, and Outcome) framework is a reliable tool for formulation a good research question (Courtney & McCutcheon, 2010). The PICO model expedites the retrieval of relevant literature from the search, in line with the research question. The advantage of using the PICO framework is simplifying the search while adding specific clues to the clinical research question (Fernandez, Tran, Ramjan, Ho & Gill, 2014). The essential part of the framework lies in helping the researcher break down the search question into manageable keywords. The keywords then facilitate the development of inclusion and exclusion criteria before commencing the search. According to Fernandez, Tran, Ramjan, Ho, and Gill (2014), EBP utilises a PICO framework to define and develop the search strategies based on a specific question. The following table shows the breakdown of the search questionin accordance with the PICO framework.

Table 1: PICO Framework

PICO FRAMEWORK	
Patient	Adults in critical care units
Intervention	Simulation practice
Comparison	Clinical skills
Outcome	Improved confidence and knowledge of nurses

Description of the Search Process
Guided by the keywords identified through the PICO Framework, the researcher embarked on a comprehensive and rigorous search process. Fernandez et al. (2014) argue that the search process requires explicit description and development in line with the research question. This systematic review process requires an explicit process because the ultimate aim is to provide evidence that can answer a specific question (LoBiondo-Wood & Haber, 2014). Consequently, using medical databases was critical in the search process. Explicitly, electronic databases wereused for the search process.

The search process utilised four databases, including CINAHL, PubMed, Ovid and the Cochrane Library. According to Rebar and Macnee (2010), the medical electronic databases provide vast literature, which reduces over-reliance on search engines and manual procedures in the library. For example, PubMed offers hosts at least 11 million health and medicine-related journals, which are under the sponsorship of the National Library of Medicine (Courtney & McCutcheon, 2010). Although accessing the large biomedical literature requires extensive searches, Grove, Gray, and Burns (2015) insist that the databases allow the researcher to use information written by a specific author. The computerised bibliographic databases offer the platform required to search the relevant empirical literature in line with the research question. However, relevant keywords or search terms should be used to initiate the search process in the databases.

The search process utilised keywords. The keywords included, 'simulation practice,' 'confidence,' 'knowledge,' 'critical care nurses,' 'efficacy' and 'clinical skills.' The search process further utilised MeSH (Medical Subject Headings) to ensure that all the keywords were included in the results. Further, Boolean Operators 'AND' and 'OR' were used to combine the keywords to increase the likelihood of generating relevant results. The Boolean operators help to retrieve articles by using different terms concurrently to improve the number of searches (Grove et al., 2015). The precision and sensitivity of the keywords determine the search results by shaping the relevance of the journal articles retrieved from the electronic databases (Modschiedler & Bennett, 2014). In addition, the search process encompasses different journals, but inclusion and exclusion criteria facilitate review based on their relevance, as wellas specificity to the research question.

Inclusion and Exclusion Criteria

Inclusion and exclusion guide the literature search and the selection of the relevant journal articles and studies required for this systematic review. The selection process is procedural, which minimises bias (Polit & Beck, 2010). The eligibility criteria utilised determine the studies that align with the parameters set by the research question. The following is a summary the inclusion and inclusion criteria used to select articles from the literature search.

Table 2: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
● Articles are written in English	● Articles are written in otherlanguages than English
● Journals published in the last 10years (2007-2017)	● Journals published more than 10years ago (Earlier than 2007)
● Includes the keywords; simulation practice, confidence, knowledge, critical care nurses, efficacy, and improved clinical skills, which define the research question for thissystematic review	● Articles that do not address the formulated research question or thekeywords specified for the search strategy

Search Outcomes

The search results differed because CINAHL, PubMed, Ovid, and Cochrane Library vary in terms of purpose and volume of literature. Although the databases vary, the primary purpose was to include results that satisfied the criteria. Determination of applicable studies depends on the research question, while the ultimate quality of search results is dependent on a hierarchy of evidence, as required in the systematic review process (Modschiedler & Bennett, 2014). Although different studies have different relevance (Houser, 2016), the research focused on quantitative studies and RCTs because these shape the insights needed for answering the research question.

The search process generated 823 studies, from CINAHL, PubMed, Ovid, and Cochrane Library combined. However, 223 studies were excluded from the list after checking their titles and abstracts. The next stage involved checking the remaining studies based on the inclusion criteria. After checking the journal articles, only 101out of 600 remaining studies met the inclusion criteria. However, the number was too large for systematic review (LoBiondo-Wood & Haber, 2014), which required examination based on the full text of the articles. This review led to the selection of 15 studies that met the inclusion criteria and were the most applicable tothe systematic review process.
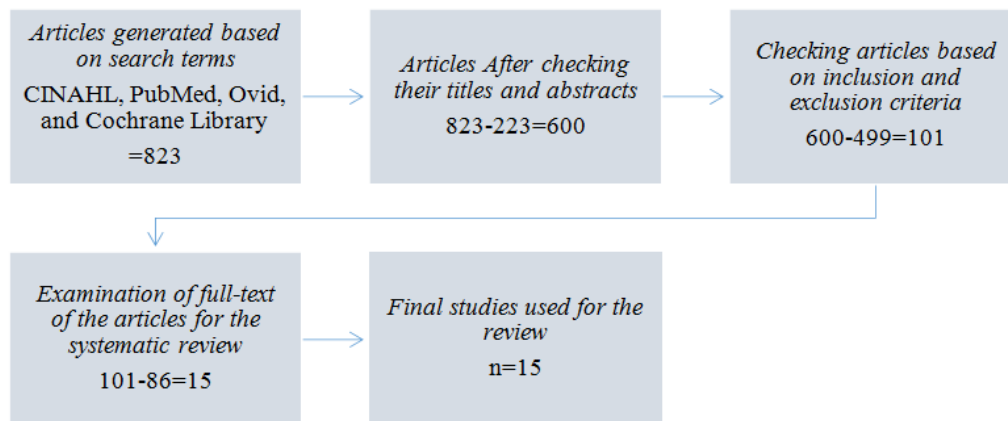
Figure 2: Literature search and retrieval for this review

Results Analysis

Analysing the quality of the journal articles was imperative to ensure that the systematic review utilised the most relevant studies. The ultimate benefit of this is the reduction of bias and subjective error, which could damage the reliability as well as the accuracy of the findings (Borbasi & Jackson, 2008). This review focused on a methodology that could facilitate a comprehensive analysis of the conclusions presented in the studies. Biased studies cannot provide explicit and verifiable results. EBP requires the use of checklists to appraise the quality and the validity of the journals or studies selected from the long list of search returns.

This systematic review used the Critical Appraisal Skills Program (CASP) tool to assess the studies for relevance. Greenhalgh (2014) views the tool as the means for testing the trustworthiness of published studies. The researcher looked at the actual results, results' validity, and their applicability in accordance with CASP framework for systematic reviews (Jewell & Jewell, 2011).

The CASP tool will be explained in detail in the findings section. The relevance and trustworthiness of the article validates the research evidence, which helps in reaching conclusions applicable in actual practice. The research focused on the studies that addressed the issue of efficacy of simulation practice in improving the confidence and knowledge of clinical skills of adult critical care nurses. The appraisal focused on the usefulness of the resultsand how they could answer the research questions.

Data Extraction

Gathering data from the selected 15 studies was critical for the systematic process. The data extraction involved checking the outcomes, validity, results and references in each journal article. The data could be subject to selection bias and error. The researcher undertook the extraction of the data with utmost care and attention to reduce selection bias, as advised by LoBiondo-Wood, and Haber (2014). The articles were summarised in a table detailing theircharacteristics and outcomes.

Synthesis of the Data

A critical appraisal of the data was utilised but based on the characteristics of the data and the results of the studies. Themes were identified in line with the research question, including the efficacy of simulation practice and improvement of confidence or knowledge of clinical skills among adult critical care nurses. This review further focused on the methodological quality of the studies. The outcomes of the results were reported.

III.   RESULTS

Introduction

This chapter analyses the results of the 15 studies chosen to address the efficacy of simulation practice in improving the confidence and knowledge of clinical skills of adult critical care nurses. The evaluation of the studies follows three themes related to the research questions. The chapter will discuss different themes emerging from the results. The chapter aims to assess the input of the studies to the understanding of simulation practice within the field of real clinical care settings. Merriman, Stayt, and Ricketts (2014) argue that the prevalence of clinical simulations does not translate into health outcomes. The analysis of these 15 studies could help to affirm the degree of effectiveness of the simulations within the context of confidence and knowledge of clinical skills.

Methodological Quality of the Studies

A critical appraisal of the 15 studies is imperative because this would help to establish theirreliability and efficacy as instructed by Hopp and Rittenmeyer (2012). The Critical Appraisal Skills Programme (CASP) is the right tool for critical appraisal for systematic reviews becauseits design facilitates reading and evaluation of existing clinical studies (Hopp and Rittenmeyer, 2012). Although other tools such as the Physiotherapy Evidence Database (PEDro) Scale or the Joanna Briggs Institute (JBI) checklist could be used, Richard (2010) insists that these are limited to specific studies such as Randomised Controlled Trials (RCTs). According to Hopp and Rittenmeyer (2012), students or clinicians can use CASP to make sense of the research evidence presented in various studies. The knowledge required in the study can be applied in nursing in practice. However, Richard (2010) insists on the need to affirm the relationship between simulation practice and confidence as well as knowledge in the clinical skills of adultcritical care nurses through evidence-based research such as systemic review used herein.

The studies included in this systematic review included 9 quantitative, 1 qualitative, 1 quasi-experimental, and 4 RCT studies. The analysis applied critical appraisal checklist of 10 questions recommended by CASP UK (2017) and Hopp and Rittenmeyer (2012). CASP UK (2017) and Hopp and Rittenmeyer (2012) developed a special checklist for this systematic review to facilitate reading of evidence gathered through various study methodologies. The checklist included questions related to validity, results, and usefulness of the findings, as shownin the table below. According to CASP UK (2017), the questions should establish the strengths,limitations, and ethical degree of the results. Appendices 1, 2, 3 and 4 summarise the critical assessment of the 15 studies in accordance with the CASP framework for this systematic review.

The critical appraisal further included evaluation of the studies based on their aim, study design, setting, sample, key findings, and the limitations involved in the process. Hopp and Rittenmeyer (2012) argued that researchers should consider the methodological comprehensiveness of a study to establish meaningful findings during a systematic review. The following table summarises the methodological details of the study that forms the basis for thecritical appraisal.

Table:5 Methodological Summary of the Included Studies

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
Quasi Experimental							
Scherer, Bruce & Runkawatt (2007)	A comparison of clinical Simulation and Case study Presentation on Nurse Practitioner Students' Knowledge and Confidence in Managing a Cardiac Event	To compare the efficacy of CSM and CSP on knowledge and confidence of nurse practitioner in a cardiac event	Quasi-experimental design with experimental and control group	School of Nursing, special room at the University of Buffalo	23 ACNP and ANP (23 for experimental; 10 for control group)	Simulation and case study presence improve outcomes of the ACNPs and ANPs	Lack of an objective structured clinical exam and short rotation time
Qualitative Studies							
Ballangrud, Hall-Lord, Persenius & Hedelin (2014)	Intensive care nurses' perceptions of simulation-based team training for building patient	To offer a description of the ICU nurses' perceptions of simulation-based team training in developing	Qualitative-descriptive	Seven ICUs in Hospital Trust in Norway	18 Registered Nurses (RNs)	Simulation increases awareness of clinical practice and the need for structured team training	Lack of real medical input and failure to consider interdisciplinary team training

safety in intensive care: A descriptive qualitative study	patient safety						

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
RCTs							
Ford et al. (2010)	Impact of simulation-based learning on medication error rates in critically ill patients	To compare the medication knowledge following simulated-based training or didactic lecture	Single-centre, parallel, controlled, and prospective RCT	24 Nurses	CCU and MICU in University of Pittsburgh Medical Centre Presbyterian Hospital	Simulation-based learning increases knowledge in medication administration for CCU and MICU nurses	Observational errors in the designation of infusion pumps
Frengley et al. (2011)	The effect of a simulation-based training intervention on the performance of established critical care unit teams	To evaluate the effectiveness of simulation-based intervention on improvement of teamwork and multidisciplinary critical care in cardiac events	Self-controlled randomised cross over design	120 doctors and nurses	Simulated critical care ward in a university simulation centre	Simulated-based study can improve multidisciplinary knowledge among critical care nursing teams	Demonstrating a nonsignificant trend of SBL over CBL
Jansson et al. (2014)	Human patient simulation education in the nursing management of patients requiring mechanical ventilation: A randomised, controlled trial	To assess the effectiveness of Human Patient Simulation (HPS) in boosting knowledge of mechanical ventilation in critical care nurses	Prospective and parallel RCT	30 critical care nurses (Intervention and control groups had 15 nurses each)	Medical, surgical ICU in Finland	HPS facilitates transfer of skills to clinical practice	Small sample size of RNs and generalisability and

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
RCTs							
Schroedl et al. (2012)	Use of simulation-based	To establish the effect of SBE on knowledge and	Prospective and cluster RCT	Simulator trained=26 and	MICU of North-western	Improved resident knowledge and	Data collection over short period and lack of pilot data for power analysis

				traditionally	Memorial	skills in MICU	
education to improve resident learning and patient care in the medical intensive care unit: A randomised trial	skills of internal medicine residents in MICU			trained=34	Hospital	for residents learning under simulated environment	

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
Quantitative Studies							
Ballangrud, Hall-Lord, Hedelin & Persenius (2013)	Intensive care unit nurses' evaluation of simulation used for team training	To execute a simulation-based programme and determine ICU nurses' use of simulated scenarios	Questionnaire evaluation	63 RNs	ICU	High self-confidence of ICU nurses following simulation-based training	Small number of participants which increased generalisability issues

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
Quantitative Studies							
Buckley & Gordon (2011)	The effectiveness ofhigh fidelity simulation on medical–surgical registered nurses' ability to recognise and respond to clinical emergencies	To assess RNs ability to respond to critical patients after immersive simulation training and use of High Fidelity Simulation (HFS)	Follow-up survey	38 RNs	Australian University Medical workshop	Simulations improved the skills of the RNsin surgical areas	Use of HFS mannequins withoutevident skin colour and body temperatures
Meurling, Hedman, Sandahl, Felländer-Tsai & Wallin (2013)	Systematic simulation-based team training in a Swedish intensive care unit: a diverse response among critical care professions	To evaluate the relationship between simulation-basedteam training (SBTT) and self-efficacy and experience of physicians, nurses and nurses' assistants	Questionnaire based	151 physicians, nurses and nurses' assistants in ICU	Karolinska University Hospital, Huddinge	Self-efficacy scores of nurses and physicians improved. Perception of collaboration and communication increased following simulation briefings	Using lower value and benchmarking data for Cronbach's α and inter-correlations

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations

Quantitative Studies							
Pascual et al. (2011)	Short Simulation Training Improves Objective Skills in Established Advanced Practitioners Managing Emergencies on the Ward and Surgical Intensive Care Unit	To evaluate usefulness of simulation training in ICU among established Advanced Practitioners (Aps)	Observation	12 Advanced Practitioners (Aps)	The Reading Hospital and Medical Center (TRHMC) and the Hospital of the University of Pennsylvania	HPS training improves self-confidence skillsin managing medical emergencies for APs	Used small sample size and lackof previous experience among participants
Roh, Issenberg & Chung (2012)	Ward Nurses' Resuscitation of Critical Patients: Current Training and Barriers	To assess barriers to acquisition of resuscitation skills among practicing ward nurses	Cross-sectional descriptive survey	459 ward nurses	11 Korean academic teaching hospitals	Increased resuscitation performance among nurses following simulation	A large sample of nurses fromnon-critical areas

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
Quantitative Studies							
Roh, Lee, Chung & Park (2013)	The effects of simulation-based resuscitation training on nurses' self-efficacy and satisfaction	To evaluate the efficacy of SBR training on patient safety skills among practising nurses	Comparative study	38 nurses (18with computer-based simulation (CBS) and 20 with mannequin-based simulation (MBS)	Hospital directed system	Simulation-based training improves nursing skills in resuscitation	The study compared the heterogeneity of simulation modalities with small sample sizes
Sandahl et al. (2013)	Simulation team training for improved teamwork in anintensive care unit	To assess the efficacy of simulation-basedtraining on Interprofessional skills in ICU	Case study method	152 ICU nurses	Karolinska University Hospital, Huddinge, Sweden	Increased patientsafety awarenessin the ICU due to simulated communication situations	Failed to deal with straightforward medical problems

Authors	Title	Aim	Design	Settings	Sample	Key Findings	Limitations
Quantitative Studies							
Wayne et al. (2008)	Simulation-Based Education Improves Quality of CareDuring CardiacArrest Team Responses at an Academic Teaching Hospital	To established the effectivenessof simulation technology on patient outcomesin cardiac arrest situations	Retrospective-case control	38 RNs	Northwestern Memorial Hospital (NMH), Chicago	Simulation-based education improved quality of care of the resident nurses in ACLS events	Small sample of events at NMHand errors or omissions in chartdocumentation
Wolf (2008)	The Use of Human Patient Simulation in ED Triage TrainingCan Improve Nursing Confidence	To assess the usefulness of HPS for decision-makingskills in emergency situations	Retrospective	13 nurses	Emergency Department	HPS improved triage decision-making among nurses in the critical care department	The study used a small samplesize and did not specify the nature of the Emergency Department (ED)

andPatient Outcomes						

Quality Appraisal of the Included Studies

This review utilised used the Critical Appraisal Skills Program (CASP) to assess the quality of the 15 studies. The tool assesses the validity, results and applicability of the findings in local settings (Hopp and Rittenmeyer, 2012). The appraisal involved assessment of quasi experimental study, RCTs, qualitative and quantitative studies. According to Polit and Becker (2012), CASP enables the appraisal of mixed method reviews to determine the approach with the best evidence for answering the research question.

Quasi Experimental Study
Study 1: Scherer, Bruce, and Runkawatt (2007)

The study was a validity study because it used a comparative analysis to assess the efficacy of clinical simulation against case study presentation and the results affirmed the objectives. The content reflected the aim and title of the study, which Polit and Beck (2010) associate with high validity. A comparative analysis provided improvement of the knowledge and confidence of nursing practitioners in managing cardiac events. The use of a comparative analysis was imperative because it enabled Scherer et al. (2007) to ascertain the efficacy of a controlled simulation mannequin (SM) with other learning strategies used to manage cardiac events.

The study by Cook et al. (2012) corroborated these findings by confirming that comparison is effective in showing efficacy when they analysed technology-based simulation versus other instructional methods. Similarly, the generalisation of the study was limited because the setting was limited to a simulated room at the University of Buffalo rather than using real care settings. Although quasi-experimental studies allow recruitment of a large sample due to non- randomisation (Polit and Beck, 2010), the study only managed a non-representative sample of 28 nurses, which affected generalisability further. However, this limited generalisation did not prevent Scherer et al. (2007) from affirming the influence of simulation experience on nurse practitioners' acquisition of skills, which answers the research question.

Scherer et al. (2007) used quasi-experimental designs to reduce time and logistical constraints. However, Polit and Beck (2010) associate quasi-experimental designs with minimal definitiveness between conclusions and causality. Furthermore, lack of randomisation was a threat to internal validity, as argued by Houser (2016). Despite both SM and case study showing similar outcomes, the data from the experimental and control group showed the significant influence of simulation on the ability of nurses to improve confidence and on their cardiac knowledge. With a post-test confidence score of p=.040, the study determined the effectiveness of the modalities used to shape the skills of nurses in the management of critical care situations. Consequently, the quasi-experimental study by Scherer et al. (2007) shows the designs that help to establish findings with minimal generalisability. As argued by Polit and Beck (2010), quasi-experimental designs have an element of practicality, which helped to boost the validity of the findings when compared to the qualitative study by Ballangrud et al. (2014).

Qualitative Study
Study 2: Ballangrud, Hall-Lord, Persenius & Hedelin (2014)

Ballangrud et al. (2014) carried out a study to affirm the importance of simulation-based training in shaping the perceptions of nurses in critical care units. The study understood the risks of failure to embrace knowledge in the intensive care environment. However, the study did not address these perceptions as possible impediments to the effectiveness of simulation, guided by another study by Pike and O'Donnell, (2010). According to Pike and O'Donnell, (2010), incorporating other methods to improve the efficacy of simulation and limit the disruptive attitude among nurses. The descriptive design utilised 18 ICU nurses who had attended simulation –based training. A qualitative content analysis facilitated the analysis of the data to illuminate the simulation-based issues that shape the perception of nurses within the context of critical care. Ballangrud et al. (2014) considered 18 intensive care units nurses, but it was impossible to apply the findings to other nurses in other Emergency Department (ED) units, due to the limited generalisability associated with a small sample of respondents. Houser (2016) insists that a sample must be representative to eliminate generalised findings. The results showed effective simulation-based training despite the study showing the limitations of generalisability that impede quality as argued by Polit and Beck (2012).

Ballangrud et al. (2014) managed to demonstrate how the simulations influence the application of self-care, reflection, and team performance of the 18 nurses in the critical care units. However, the descriptive methodology increases the possibility of subjectivity and error due to the involvement of the researcher (Neergaard, Olesen, Andersen, Sondergaard, 2009). The study did not demonstrate the direct relationship between simulation practice and knowledge or clinical skills or nurses, as in the study by Cook et al. (2012), but

the increased awareness of clinical practice and the acknowledgment of structured teamwork could still translate into improved clinical skills, in accordance with Pike and O'Donnell (2010). RCTs presented a more convincing methodology than Ballangrud et al. (2014) their view of efficacy simulation, because they are higher in the hierarchy of evidence, as shown in Figure 1.

RCTs
Study 3: Ford et al. (2010)
The study sought to establish the efficacy of simulation from the perspective of medication administration skills. Ford et al. (2010) understood the occurrence of medication errors in the critical care unit such as Coronary Care Unit (CCU) and Medical Intensive Care Unit (MICU), guided by the connection between the objectives and the findings. Deploying a sample of 24 nurses was imperative because it anchored the representativeness of the findings and the conscious bias to guarantee the study's external validity as advised by Suresh (2014). The clear study design aided understanding of the influence of simulation from two critical care units due to the use of the right methodological framework. Houser (2016) argues that a prospective study should focus on outcomes, which Ford et al. (2010) demonstrates bycomparing simulation and didactic lecture methods.
The results were based on a well-designed RCT study, which showed administration of402 CCU and 478 MICU doses, but the error rates decreased from 30.8 to 4% following the simulation-based training. The didactic lecture did not show any significant difference in the error rate committed by nurses, despite showing increased mean quiz scores after the educational session. Suresh (2014) associates the comparative approach with strong evidence, which should be reflected in the results. The results were valid and reliable, considering Ford et al. (2010) showed a clear relationship between simulation and patient care, which was affirmed by another study by Cook et al. (2012). Nurses managed to offer the required clinical care through a reduction of errors in medical administration, which translated into optimum patient care despite the simulation emerging as more effective than lecture style education in improving the care skills of nurses. Flynn, Liang, Dickson, Xie, and Suh (2012) corroborated the findings by viewing simulation as an indispensable tool in error interception practices within critical care environments. However, Frengley et al. (2011) had a different approach to evaluating the efficacy of simulation, which promoted more in-depth findings than those of Ford et al. (2010).

Study 4: Frengley et al. (2011)
The self-controlled randomised study utilised the Human Patient Simulation (HPS) environment to establish their effectiveness in improving teamwork performance within the field of critical care units. The self-controlled true intervention should have a true intervention when compared to the retrospective approach by Ford et al. (2010). Frengley et al. (2011) utilised a representative sample of 40 teams, which Houser (2016) associates with accurate findings. The simulation centre at the university was critical in establishing the efficacy of simulations in the management of airway and cardiac crises, which represent some of the critical care situations in healthcare institutions. The limitation of the data collection to 10 hours should have affected the quality of the intervention, as argued by Polit and Beck (2010), but they managed to undertake sufficient pre-intervention and post-intervention work for the assessment of simulations. The methodological quality was high due to the use of RCT, which Polit and Beck (2010) associate with reduction of selection bias and confounding issues through comparison.
Frengley et al. (2011) carried out an intervention that showed significant improvements(p<.002) on leadership and team coordination as well as for verbalising situational information. The behavioural factors inclined to the channels that improve the care delivery of nurses within adult critical care units, as Pike and O'Donnell (2010) state that these reduce errors. The improvement in clinical management affirmed the effectiveness of the study, which meant that nurses could use the simulated skills to boost patient management. The clear analysis and identification of population helped Frengley et al. (2011) present findings that affirmed the influence of simulation on multidisciplinary critical care unit teams, as confirmed in a similar study by Aggarwal et al. (2010). Although case-based learning established similar outcomes, simulation stood out as an effective teaching strategy for nurses working in ICUs with adult patients. Similarly, findings emerged from Jansson et al. (2014) considering analysis of HPS but with reliability due to the statistical element of analysis.

Study 5: Jansson et al. (2014)
Jansson et al. (2014) assessed the efficacy of HPS in boosting the management of patients needing mechanical ventilation. The RCT utilised a representative sample of 30 critical care nurses who met the inclusion criteria established in the study. The use of a representative sample aligns with the structure of RCTs, which increases the statistical reliability of a study (Polit and Beck, 2010). The need to establish the effectiveness of HPS education required the researchers to focus on using equal intervention and control groups of 15 participants, which was also seen in another study (Pike & O'Donnell, 2010). The deployment of Ventilator Bundle Questionnaire and Observation Scheduled helped to make valid observations within the simulation settings of

MSICU in Finland. The short period should have affected the intervention and generalisability of the findings, but Jansson et al. (2014) made clear observations about the changes in skills of nurses following HPS education, which aligned withthe objective of the study.

Consequently, the results had high validity, and showed an increase in average skills scores from 46.8% to 60% for the intervention group undertaking HPS education. The score improved during the post-intervention observation. The knowledge score for the control group did not show any significant difference. The findings of Jansson et al. (2014) showed that nurses transfer the skills learned through simulation to respond to ICU situations. The findings were correct, considering that Buykx et al. (2011) found that simulation education enhances patient management skills of nurses. Consequently, a clear relationship between HPS education and performance of mechanical ventilation occurred based on the high skill scores emerging from the study by Jansson et al. (2014), which demonstrated the applicability and reliability of its findings. However, it was easier to identify the improvement of knowledge and skills in clinical skills from the RCT by Schroedl et al. (2012).

Study 6: Schroedl et al. (2012)

Schroedl et al. (2012) aimed to define the efficacy of simulation on the improvement of the knowledge and skills using a randomised sample of residents in the MICU. The study collected data for one year, which ensured the engagement of the intervention and control groups of 26 and 34 participants respectively. Subsequently, the comparative aspect maximised the generalisability of the findings. The study managed to record data from residents who undertook simulation education in circulatory shock, respiratory failure, and mechanical ventilation. A 2-tailed independent sample t-test enabled the research to compare performance for simulation-trained and traditionally engaged residents. Undertaking a comprehensive statistical analysis was a boost to the validity of the results, as required or allowed by a randomised study and recommended by Suresh (2014).

The results of the RCT showed a significant influence of the simulation on bedside skills including for circulatory shock, mechanical ventilation, and response to respiratory failure. The quality of findings could be attributed to RCT methodology, as it enhances comparison, which leads to superior findings (Houser, 2016) A significant difference emerged from simulator- trained and traditionally engaged residents, as Pike and O'Donnell (2010) found that training has different outcomes. The simulation showed an 82.5% score, while the traditional approach garnered 74.8%, which showed the effectiveness of the simulation programme. The results showed a clear link between simulation education and residents' knowledge as well as in their skills in performing bedside tasks in the MICU. The knowledge or skills acquired through the simulation education helped the residents to respond to critical care issues within the MICU. The affirmation of the valuable role of simulation practice in improving standard clinical training by Schroedl et al. (2012) was also the outstanding element in the study by Pike and O'Donnell (2010), but which Ballangrud et al. (2013) affirmed with a descriptive research design.

Quantitative Studies

Study 7: Ballangrud, Hall-Lord, Hedelin & Persenius (2013)

Ballangrud et al. (2013) aimed to understand the perceptions of nurses towards simulation and the subsequent improvement of competencies within intensive care. The primary element of the study was the improvement of patient safety, which Suresh (2014) understands as a top priority in any ED or ICU. Eighteen ICU nurses were recruited for the qualitative descriptive design and their insights were analysed through content analysis. However, the reliability of the findings was low, as Suresh (2014) associates this analysis type with high subjectivity error or flawed interpretation. Notwithstanding, the design facilitated archival or rich data alongside a representative sample of 63 samples. Although the research evaluated insights from different categories, including reflection and openness to motivation learning, Naik and Brien (2012) found that ICU nurses' perception and the ability to execute their skills within the field of critical care determines the ultimate outcome. Consequently, the study showed the realistic aspect of simulation by affirming how it improves self-care skills among ICU nurses, which Schroedl et al. (2012) corroborated through RCT. Finding an intersection between simulation training and team performance further affirmed their efficacy in the clinical practice of adult critical care nurses, but the use of a descriptive design complicates the establishment of cause and effect, as argued by Suresh (2014). Conversely, Buckley and Gordon (2011) showed more reliable findings because the follow-up survey reliedon an unchanged simulation environment.

Study 8: Buckley & Gordon (2011)

The aim of the study by Buckley and Gordon (2011) was to find evidence that would link the association skills of medical, surgical nurses and the response to deteriorating situations after undertaking simulations. The follow-

up survey used 38 Registered Nurses (RNs) who underwent immersive simulation and High Fidelity Simulation (HFS). However, the study should have used a more representative sample, considering a survey allows the researcher to reach out to a wide population (Roe & Webb, 2008). The study was part of a university graduate investigation, which affected the generalisability to real critical care settings, but it helped to interrogate the HFS and immersive simulation training and the extent to which it could change clinical practice skills during emergencies. The study had quality findings, as Rohleder, Lewkonia, Bischak, Duffy, and Hendijani (2010) assessed the skills level and usefulness of simulation-based skills in real critical care events in orthopaedics and affirmed the positive contribution of clinical knowledge.

The findings showed that using simulation-based modalities could increase the ability to respond to emergency events in real care settings. Explicitly, handling 164 clinical patient emergencies in a systematic way showed the significant influence of simulation, which aligned with the aims of the study. The quality findings can be attributed to the follow-up element of the survey, which shows research with high internal validity. According to Houser (2016), the follow-up survey enhances retrospection, which reduces research errors. While the simulation-based concepts of scenario debriefing and assertiveness training helped, the findings showed that the clinical experience of the ICU nurses could require the acquisition of contemporary knowledge to manage emergency events. Buckley and Gordon (2011) affirm that any form of simulation could facilitate the capacity of nurses in handling cardiac, respiratory, and electrolyte disturbances. Naik and Brien (2012) confirm that these situations are common in adult critical care nursing and require optimal attention from the RNs.

Study 9: Meurling, Hedman, Sandahl, Felländer-Tsai & Wallin (2013)

The focus of the study by Meurling et al. (2013) was the effectiveness of simulation in improving response skills in Swedish ICUs. The researchers understood the essence of collaboration and communication in creating safe healthcare. However, the researchers did not establish the link between Simulation-Based Team Training (SBTT) and the self-efficacy of nurses in practice, which showed a weaker study when compared to Buckley and Gordon (2011) and Naik and Brien (2012), who associated this with possible reduction in safety practices. Although the study utilised a representative sample of 151 nurses, physicians, and nurse assistants to promote generalisability, low understanding of the efficacy of simulation was evident. The nurses underwent training in simulation for 2 years. A self-efficacy questionnaire helped in collecting data with a primary focus on the climate and the overall safety practice of the practitioners, but Houser (2016) associates the tool with researcher subjectivity and possible errors.

Meurling et al. (2013) analysed the questionnaire responses with a view to affirming the perception of nurses towards the Safety Attitudes Questionnaire (SAQ) factors. Those factors shaped the outcomes of the patients within ICUs in Sweden. The findings of the studies did not link simulation-training efficacy to nurses, but encompassed physicians and nurse assistants in ICUs. Consequently, the study utilised the right methodology but the findings could not be generalised to a critical care setting. The study should have been carried out as with Smith and Cole's (2009), who found that there must be an element of teamwork to avoid disruption from poor nurse attitudes or perceptions. According to Polit and Beck (2010), time allows comparison of different nursing activities, which can corroborate the efficacy of simulation practice. Conversely, Pascual et al. (2011) had a better methodology and generalisable findings about the efficacy of simulation than those of Meurling et al. (2013).

Study 10: Pascual et al. (2011)

The research focused on establishing the influence of simulation training on the objective skills of practitioners managing critical care units. Pascual et al. (2011) decided to use Advanced Practitioners (Aps) and take them through HPS training and establish any improvement in their skills at managing medical crises. The researchers first sought ethical approval, which paved the way for use of 12APs in SimMan and Laedral System for simulations. Additionally, using a cohort perspective in the study boosted methodological quality, but the study achieves a lower quality of evidence compared to other RCTs used in the study (Schroedl et al., 2012; Jansson et al., 2014). Houser (2016) argues that cohort studies help in determining the link between exposure and outcomes. The 12 APs participated in different scenarios, including team leadership and observations, as well as a debriefing session through video replay, which injected an element of comparative analysis for Pascual et al. (2011), intended to link to efficacy of simulation practice. However, no effort was made to have a representative sample and facilitate establishment of multiple outcomes as required by a cohort study.

Pascual et al. (2011) observed an improvement in the scores of the participants. A study by Griswold et al. (2012) validated these findings by showing the link between short simulations and improvements which occurred in leadership, interpersonal, and overall medical skills. A significant improvement ($p<0.05$) showed the

effectiveness of simulation in increasing the capacity of nurses to attain self-confidence skills, among other skills in the management of medical emergencies. Pascual et al. (2011) showed that HPS could become the basis for training APs and could shape their skills in delivering quality patient outcomes. Roh, Issenberg and Chung (2012) had stronger arguments and more generalisable findings, considering the use of a bigger sample than Pascual et al. (2011).

Study 11: Roh, Issenberg, and Chung (2012)
Roh et al. (2012) focused on establishing the relationship between simulated resuscitation skills and the skills of ward nurses. The research utilised a representative sample of 459 nurses in a Korean teaching hospital, Houser (2016) argues that a representative sample enhances the establishment of quality findings by reducing selection bias. Out of the 459 nurses, 36% received training through simulation in resuscitation skills. The study investigated barriers such as insufficient training, lack of competence and self-confidence. However, the findings established that indeed, 36% of nurses improved their resuscitation performance in critical care when compared to nurses who did not receive any guidance.
Contrasting findings by Griswold et al. (2012) portray optimal resuscitation performance as a product of successful simulation practice among critical care nurses. Additionally, using a descriptive cross-sectional study is not ideal for a critical issue such as simulation, as recommended by Suresh (2014), due to the time-consuming nature of the method and the possibility of analysis errors. Nonetheless, the link between simulation practice and improvement of knowledge and skills in critical care was clear, which promoted applicability in care settings.

Study 12: Roh, Lee, Chung, and Park (2013)

The efficacy of simulation training on the self-efficacy and satisfaction of nurses was under test when Roh et al. (2013) carried out a comparative study. The study takes into account the different simulation practices that could influence the way nurses in critical care units could improve their self-efficacy. The study used a small sample size of 38 nurses, who underwent computer-based simulation (CBS) and mannequin-based simulation (MBS) training in readiness for managing a cardiac arrest patient, which rendered the methodology biased due to selection issues (Suresh, 2014). The rating of the participants' performance was undertaken to understand if their training conformed to the efficacy needed in high-quality resuscitation and patient safety.
The results of the study show an overall rating of 6.50 in self-efficacy and 7.53 in satisfaction for the groups that undertook CBS and MBS. While the study does not show significant differences between the groups, the findings show that the use of simulation-based resuscitation is beneficial to nurses. A similar study by Satava (2009) acknowledged the medical revolution of simulation to affirm the usefulness and effectiveness of the simulation exercise in shaping the nursing experience, which emerged in the study by Roh et al. (2013). Consequently, the study showed that simulation aligns performance expectations with the subsequent delivery of care needed in adult critical care units.

Study 13: Sandahl et al. (2013)

Sandahl et al. (2013) understood the role of simulation training in the education of nurses, but the relation with ICU performance or efficacy was not clear, as was demonstrated in another study (Smith and Cole, 2009). However, the study utilised the input of 152 nurses from the ICU of Karolinska University Hospital, which created the foundation for established objective findings, as recommended by Suresh (2014). The aim of the case study was to develop a description of the implementation of simulator-based training and the effect it would have on the professional capacity of the ICU team at the university hospital. Interviews with the staff revealed a significant appreciation of simulation but the subsequent findings could only be limited to the team due to the use of a case study methodology. According to Houser (2016), case studies restrict application or generalisation to a wider population due to the theoretical nature of the data.
The intervention group needed to train through simulation so that ICU teams could communicate ways of handling difficult situations that impede optimal patient safety. However, Satava (2009) found contrasting findings, suggesting the short-lived nature of simulated training, in which the university failed to incorporate it into organisational features such as rotas and schedules of rounds. Consequently, the efficacy of simulation practice is the product of an array of factors, including ingrained learning behaviour among critical care nurses. The ultimate knowledge and confidence in handling critical care emerging from a hospital sustains a constant learning system in the form of simulation, as argued by Pike and O'Donnell (2010).

Study 14: Wayne et al. (2008)

The growing influence of simulation technology inspired the study by Wayne et al. (2008). The research aimed to find a link between the simulation and the patient care outcomes of the cardiac arrest team. While the study used a controlled environment to gain insights into the efficacy of simulation technology, the retrospective case-control study utilised simulator and traditionally trained groups. Wayne et al. (2008) achieved an element of efficiency with a retrospective case-control study in assessing how nursing education would affect ACLS records within the cardiac department. The retrospective aspect of the study promotes efficient assessment of cause and effect (Polit and Beck, 2010). The results showed a significant difference between the simulator-based education and traditionally trained residents. Okuda et al. (2009) agreed that simulation technology supersedes traditional methods by elimination of skills execution gaps in critical care.

With simulator training showing 60% adherence to American Heart Association (AHA) standards and improvement in the quality of care of the cardiac arrest patients, Wayne et al. (2008) established findings that affirmed its efficacy. These findings aligned with the study by Griswold et al. (2012), which showed the slow transition from the traditional methods of training critical care nurses to simulation-based approaches. The actual outcomes of the study are important in showing the influence of simulation on the outcomes of ACLS and overall application of medical knowledge by nurses working in adult critical care units. However, Wayne et al. (2008) insist that future studies should use an RCT approach to carry out intervention and control group trials. Houser (2016) associates RCTs with statistical reliability and bias minimisation.

Study 15: Wolf (2008)

Wolf (2008) aimed to assess the appropriateness of simulation in influencing the acquisition of proper skill sets among nurses working in critical care units. The study focused on establishing the requirements needed to expedite functions within the ED, including education and the subsequent delivery of quality care. The use of 13 nurses in the simulation laboratory was in line with the process-oriented framework that Houser (2016) associates with affirmation of the role of clinical simulation to influence the practice of the thirteen nurses. Deploying Laerdal SIM MAN was imperative for the study, due to the practical element of the tool. Parrillo and Dellinger (2014) argue that Laerdal SIM MAN is effective for scenario-based simulation training.

The data showed a significant influence of simulation on the nursing performance in the ED. Similarly, Naik and Brien (2012) found that simulation could help in handling issues that emerge within the ED if the intention is to maximise patient safety. Wayne et al. (2008) presented findings that affirmed the connection between decision-making and simulation practice, but the research suggested combination with didactic methods to foster quality patient outcomes. According to Suresh (2014), different instructional tools enhance knowledge, confidence and clinical skills. Guided by the diverse demands in the ED, the influential role of simulation could help in boosting the confidence of nurses undertaking triage-nursing roles.

IV. DISCUSSION

Introduction

This chapter discusses the key findings from analysis of the results of the 15 studies selected for this systematic review. Different themes related to the research question emerged from the findings, including diverse views about the efficacy of simulation in the provision of adult critical care. The adoption of simulation skills and their implementation by nurses in adult critical care units was evident in this review. This chapter uses a critical approach to discuss the results focusing on efficacy of simulation practice, the aspects of confidence and knowledge of clinical skills in the dispensation of adult critical care by nurses, and the fundamental issues that some of the 15 researchers have identified as critical. The discussion helps to answer the research question in detail.

Patient Safety in Critical Care Settings

The critical appraisal of the studies showed that simulation boosts the performance of nurses within critical care settings where the priority is to maximise patient safety. The analysis by Frengley et al. (2011) shows that the transfer and successful implementation of Human Patient Simulation (HPS) skills in critical care units determines the quality of patient outcomes. Although the findings focus on the performance of critical care nurses, Robinson and Dearmon (2013) argue that the retention of the skills learned through simulation practice is an integral element in the patient management within the adult critical care units. Nurses can use a simulated critical care, which Garrett, MacPhee and Jackson (2011) associate with the ultimate aim of maximising the patients' well-being. Consequently, the achievement of quality patient outcomes depends on the effectiveness of the simulation-based intervention sustained and executed by adult critical care nurses guided by evaluation of the Canadian care context by Garrett et al. (2011).

Frengley et al. (2011) view patient safety as the outcome of efficacious implementation of simulation practice. The dispensation of critical care should occur through teamwork, as recommended by Janssen, Wimmer, and Deljo (2015) after evaluation of National Health Services' critical care procedure. Simulation practice fosters team training, which then compels nurses to adopt an interdependence approach within the emergency units (Abbenbroek, Duffield & Elliott, 2014). Ballangrud et al. (2013) insist that the use of a team-training approach should align with the perception of nurses on critical care. The efficacy of simulation practice in providing patient safety requires commitment in critical care nurses' behaviour, scenario roles, and the good use of clinical skills learned through simulation (Frengley et al., 2011). Although Abbenbroek et al. (2014) state that fatigue could become an impediment in critical care and execution of simulation skills, Scholtz, Nel, Poggenpoel, and Myburgh (2016) state that the interdependence of nurses maintains and protects patients' wellbeing.

Confidence in Critical Care Units
Simulation practice improves the response to emergencies by shaping nurses' execution of clinical skills with confidence and precision. Buckley and Gordon (2011) found that the effectiveness of High Fidelity Simulation (HFS) becomes evident when medical-surgical RNs focus on identifying and responding to the problems emerging within critical care units. The RNs can identify issues that face adults in emergency units but Karanikola et al. (2013) note that they do this efficiently when they have undergone intensive training, for example, HFS and immersive simulation, to improve their confidence. Although Frengley et al. (2011) insist on the use of a teamwork approach to improving confidence, the overarching element in critical care is the usefulness of the simulation skills during the response to actual emergency events such as cardiac arrests and electrolyte disturbances.
Ford et al. (2010) associate simulation with the improvement of self-confidence among critical care nurses. Shearer (2012) argues that the priority is the reduction of errors, which is an important indicator of how well nurses retain and implement simulation skills. Correspondingly, Ford et al. (2010) contend that the reduction of medication errors in the nursing management of critically ill patients requires practice. As argued by Ballangrud et al. (2013), the demonstration of confidence and the use of proper skills in administering nurses shows how well simulation practice offers an added advantage in critical patient care.

Efficacy of Simulation Skills
This review acknowledges the influence of simulation practice within real care settings to continue the provision of optimum patient care. Jansson et al. (2014) argue that approaches such as HPS should expedite implementation of mechanical ventilation to facilitate execution of clinical skills, as shown by Grant, Moss, Epps, and Watts (2010) when they evaluated the student-based context of simulation practice. The skills learned through simulation in the class determine success in critical care nursing management (Grant et al., 2010), but an adult critical care nurse has to demonstrate confidence and optimal knowledge, for example when performing activities such as mechanical ventilation. As recommended by Ballangrud et al. (2013), the efficacy of simulation should lead to the confidence of nurses so that the primary outcome is patient safety within the field of critical care settings in hospitals. This means that simulation skills are useful for critical care nurses. However, the effectiveness element of the teaching method determines the extent to which RNs can demonstrate the confidence to execute their learned skills (Lucas, 2014). Schroedl et al. (2012) showed that medical ICUs require RNs to take in relevant knowledge, but that simulation has a higher effect on the degree to which they improve confidence and the subsequent knowledge and skills for managing medical ICU patients.

Importance of Simulation Skills in Practice
Comprehensiveness of simulation practice and nurses' ability to acquire skills determines efficacy and its capacity to improve the confidence and knowledge of clinical skills among adult critical care nurses. According to Roh et al. (2013), the provision of resuscitation skills in emergency units requires nurses who have undergone comprehensive training through simulation. The findings from the study by Roh et al. (2013) show the ability to overcome barriers. Lucas (2014) agrees that execution of clinical skills faces barriers, such as burnout and instant decision-making in the administration of care for patients. However, evaluation in the Canadian healthcare context by Garrett et al. (2011) has affirmed that simulation-based learning becomes an effective way of building the confidence needed to perform resuscitation, among other services needed within adult critical care units.
The length of the simulation training or learning does not matter, but the ultimate outcome should be objective clinical skills. According to Pascual et al. (2011), short simulation training should help advanced practitioners adopt quality management of emergencies within the field of the ward and surgical ICUs. The approach does not focus on critical care alone, but affirms the need to have a simulated experience of emergency issues, which Garrett et al. (2011) associate with confidence building. However, Tschannen, Aebersold, McLaughlin, Bowen, and Fairchild (2012) find that short simulation training focuses on skills acquisition

alone among baccalaureate nursing students, which should be considered as a basis for building the confidence of nurses in the administration of critical care to adult patients. Roh et al. (2013) argue that skills should translate into self-confidence in the management of medical emergencies in ICUs.

Leadership in Critical Care Teams

Frengley et al. (2011) found that connection between simulation practice and improvement of clinical knowledge or confidence in nurses occurs when structured under the leadership to foster empowerment and reduce demotivation. Although the study used a university simulation centre rather than a real health care setting to arrive at the finding, the intervention showed that verbalising situation performance through leaders should facilitate proper execution of patient management skills within critical care units. Consequently, leadership fosters the multidisciplinary influence of simulation practice and has quality outcomes greater than when adult critical care nurses undertake patient care individually. Frengley et al. (2011) further argue that the demonstration of confidence and improvement of skills requires a resonant leadership that fosters positive working relationships among critical care nurses.

Multidisciplinary Collaboration

Multidisciplinary collaboration should sustain the self-efficacy of nurses, guided by an evaluation of critical care practices (Meurling et al., 2013; Scholtz et al., 2016). This agrees with Frengley et al. (2011), who might have evaluated teamwork in simulation-based training and implementation in the critical care units but its success depends on how well nurses use other disciplines such as therapy units to promote confident decision-making. With the provision or improvement of patient safety and care remaining a critical challenge in ICUs (Garrett et al., 2011), critical care nurses should communicate with other units to ensure successful use of skills to provide optimum care. Meurling et al. (2013) take the view that collaboration with different disciplines should foster utilisation of maximum clinical skills andensure delivery of quality patient outcomes.
Meurling et al. (2013) view critical care skills as a product of simulation-based team training (SBTT). SBTT could occur against a background of collaboration and communication, but the important goal is the ability of nurses to use the learning sessions to build their confidence (Shearer, 2012). The demonstration of competence should occur when administering mechanical ventilation, medication or the basic response to shock emergencies (Ballangrud et al., 2014; Frengley et al., 2011). Consequently, simulation-based training ensures collaboration, where nurses can consult colleagues to build the intervention skills needed to respond to emergencies.

Communication among Nurses
The element of communication emerged from the findings of Sandahl et al. (2013). However, communication influences the usefulness of simulation when nurses adopt interprofessional working within the ICU. Difficult care situations cannot be learned through conventional education alone, as demonstrated by Bingham, Sen, Finn, and Cawley (2015) when they analysed use of a high-fidelity mannequin for nursing training sessions. The confidence and the knowledge of nurses depends on how well they can engage in critical care situations in a simulated environment, but Lucas (2014) argues that communication remains an integral element in the achievement of patient safety and exploiting adequate learning behaviours. Sandahl et al. (2013) show that the sustainability of efficacy of simulation practicedepends on the communication between nurses and physicians.

Summary
The relationship between efficacy of simulation practice and confidence in as well as knowledge of the clinical skills of adult critical care are clear. This chapter shows that simulation practice creates the channel needed by nurses to acquire the competence needed to handle different emergency care issues within the ICUs. However, critical analysis of the articles shows the need to adopt resonant leadership, collaboration, communication, and overall performance-oriented input for simulation to improve confidence and knowledge of clinical skills among adult critical care nurses.
The following themes have emerged from this discussion; patient safety, confidence, efficacy, skills, leadership, collaboration and communication. Therefore, it can be concluded that simulation practice improves confidence and knowledge in clinical skills for adult criticalcare nurses.

V. CONCLUSION
The study aimed to establish if simulation practice could improve confidence and knowledge of clinical skills in adult critical care nurses. The research used a systematic review, which entailed analysis of existing studies. This review of 15 studies sourced from different databases has helped to find the relationship between the efficacy of simulation practice and confidence as well as the knowledge of clinical among nurses

working as critical care nurses. The discussion of the different perspectives emerging from the 15 studies showed a unanimous agreement that simulation practice improves confidence and knowledge among nurses working in critical care units. The adoption of the learning aspect of simulation and the transference of lessons to adult critical care emerged as the most influential aspects for the critical care process. The analysis and subsequent analyses were anchored on the understanding that simulation learning is intended to facilitate skill acquisition by shifting attention from ineffective traditional channels of teaching: for example, lectures (Wayne, 2008; Schroedl et al., 2012). The analysis affirmed that improvement in the confidence and knowledge among nurses occurred due to the understanding of patient management issues, from basic drug administration to the use of simulated critical care skills to deal with complex situations. The studies assessed participants with significant nursing knowledge who were under strict instructions to maximise patient outcomes by reducing medical errors. However, the systematic review showed that nurses must have or adopt a few supporting skills to sustain their confidence and expand their knowledge of clinical skills in adult critical care. These skills include leadership, team coordination, communication, and satisfaction with schedules, as well as remuneration. The findings have implications for nursing practice.

Suggestions for Nursing Practice

Nursing schools and health care institutions should prioritise the adoption of simulation practice. Institutions should use the learning approach for skill-building among those nurses who are under residency. The demonstration of confidence and knowledge of clinical skills should occur against a backdrop of well-paid and satisfied workers, because nurses are not generally particularly well paid, and the profession is currently under a great deal of pressure (Lucas, 2014). In addition, the execution of clinical skills and the demonstration of knowledge should be used to shape patient management outcomes in critical care units. The systematic review shows that nursing practitioners cannot use or demonstrate knowledge without proper communication structures. Correspondingly, putting up the right leadership structures and promoting teamwork is essential to create sustainable use of the skills acquired through simulated nursing care. The sensitivity of adult critical care requires nurses who can undergo constant learning through simulation practice rather than depend on skills passed on through lectures.

Implications for Future Research

This systematic review concentrated on diverse studies with varied methodologies. Evaluating the different perspectives of authors was imperative, but the use of varied research designs limited the interpretation of the study outcomes. Future research involving systematic review should focus on randomised controlled trials, and quantitative or quasi-experimental designs. Mundi, Pindiprolu, Simunovic and Bhandari (2014) demonstrate that a systematic review of studies with similar methodological designs, such as RCTs, could establish similar outcomes regarding the improvement of confidence and the knowledge of clinical skills among adult critical care nurses.

Acknowledgement

References

[1]. Abbenbroek, B., Duffield, C., & Elliott, D. (2014). Selection of an instrument to evaluate the organisational environment of nurses working in intensive care: an integrative review. *Journal of Hospital Administration*, *3*(6). doi: http://dx.doi.org/10.5430/jha.v3n6p143.

[2]. Abe, Y., Kawahara, C., Yamashina, A., & Tsuboi, R. (2013). Repeated Scenario Simulation to Improve Competency in Critical Care: A New Approach for Nursing Education. *American Journal of Critical Care*, *22*(1), 33-40. doi: http://dx.doi.org/10.4037/ajcc2013229.

[3]. Aggarwal, R., Mytton, O., Derbrew, M., Hananel, D., Heydenburg, M., & Issenberg, B. et al. (2010). Training and simulation for patient safety. *Quality and Safety in Health Care*, *19*(Suppl 2), i34-i43. doi: http://dx.doi.org/10.1136/qshc.2009.038562.

[4].   Al-Elq, A. (2010). Simulation-based medical teaching and learning. *Journal of Family and Community Medicine*, *17*(1), 35-40. doi: http://dx.doi.org/10.4103/1319-1683.68787.
[5].   Aydin, A., Ahmed, K., Shafi, A., Khan, M., & Dasgupta, P. (2016). The role of simulation in urological training – A quantitative study of practice and opinions. *The Surgeon*, *14*(6), 301-307. doi: http://dx.doi.org/10.1016/j.surge.2015.06.003.
[6].   Baillie, L., & Curzio, J. (2009). Students' and facilitators' perceptions of simulation in practice learning. *Nurse Education in Practice*, *9*(5), 297-306. doi: http://dx.doi.org/10.1016/j.nepr.2008.08.007
[7].   Ballangrud, R., Hall-Lord, M., Hedelin, B., & Persenius, M. (2013). Intensive care unit nurses' evaluation of simulation used for team training. *Nursing in Critical Care*, *19*(4),175-184. doi: http://dx.doi.org/10.1111/nicc.12031
[8].   Ballangrud, R., Hall-Lord, M., Persenius, M., & Hedelin, B. (2014). Intensive care nurses' perceptions of simulation-based team training for building patient safety in intensive care: A descriptive qualitative study. *Intensive and Critical Care Nursing*, *30*(4), 179-187. doi: http://dx.doi.org/10.1016/j.iccn.2014.03.002.
[9].   Bingham, A., Sen, S., Finn, L., & Cawley, M. (2015). Retention of Advanced Cardiac LifeSupport Knowledge and Skills Following High-Fidelity Mannequin Simulation Training. *American Journal of Pharmaceutical Education*, *79*(1), 12.
[10]. doi: http://dx.doi.org/10.5688/ajpe79112.
[11]. Blackburn, S. (2014). Role of simulation in training the next generation of endoscopists. *World Journal of Gastrointestinal Endoscopy*, *6*(6), 234.doi: http://dx.doi.org/10.4253/wjge.v6.i6.234.
[12]. Borbasi, S., & Jackson, D. (2008). *Navigating the Maze of Nursing Research*. London:Elsevier Health Sciences APAC.
[13]. Brady, A., Malone, A., & Fleming, S. (2009). A literature review of the individual and systems factors that contribute to medication errors in nursing practice. *Journal ofNursing Management, 17*(6), 679-697.
[14]. Brewer, E. (2011). Successful Techniques for Using Human Patient Simulation in Nursing Education. *Journal of Nursing Scholarship*, *43*(3), 311-317. doi: http://dx.doi.org/10.1111/j.1547-5069.2011.01405.x.
[15]. Bronson, D., & Davis, T. (2012). *Finding and Evaluating Evidence*. Oxford: OxfordUniversity Press.
[16]. Buckley, T., & Gordon, C. (2011). The effectiveness of high fidelity simulation on medical– surgical registered nurses' ability to recognise and respond to clinical emergencies. *Nurse Education Today*, *31*(7), 716-721. doi: http://dx.doi.org/10.1016/j.nedt.2010.04.004.
[17]. Buykx, P., Kinsman, L., Cooper, S., McConnell-Henry, T., Cant, R., Endacott, R., & Scholes,
[18]. J. (2011). FIRST2ACT: Educating nurses to identify patient deterioration — A theory- based model for best practice simulation education. *Nurse Education Today*, *31*(7), 687-693. doi: http://dx.doi.org/10.1016/j.nedt.2011.03.006
[19]. CASP UK. (2017). *Critical Appraisal Skills Programme (CASP)*. Retrieved fromhttp://www.casp-uk.net/checklists
[20]. Cook, D., Brydges, R., Hamstra, S., Zendejas, B., Szostek, J., & Wang, A. et al. (2012).
[21]. Comparative Effectiveness of Technology-Enhanced Simulation versus other Instructional Methods. *Simulation in Healthcare: The Journal of The Society forSimulation in Healthcare*, *7*(5), 308-320. doi: http://dx.doi.org/10.1097/sih.0b013e3182614f95
[22]. Cormack, D., & Gerrish, K. (2011). *The Research Process in Nursing*. Chichester: Wiley-Blackwell.
[23]. Courtney, M., & McCutcheon, H. (2010). *Using evidence to guide nursing practice*.
[24]. Chatswood, N.S.W.: Elsevier Australia.
[25]. Cronin, E., Nielsen, M., Spollen, M., & Edwards, N. (2010). *Adult Critical Care*.
[26]. Birmingham: University of Birmingham.
[27]. Egger, M., Smith, G., & Altman, D. (2008). *Systematic Reviews in Health Care*. London:John Wiley & Sons.
[28]. Fernandez, R., Tran, D., Ramjan, L., Ho, C., & Gill, B. (2014). Comparison of four teaching methods on Evidence-based Practice skills of postgraduate nursing students. *Nurse Education Today*, *34*(1), 61-66. doi: http://dx.doi.org/10.1016/j.nedt.2012.10.005
[29]. Flynn, L., Liang, Y., Dickson, G., Xie, M., & Suh, D. (2012). Nurses' Practice Environments, Error Interception Practices, and Inpatient Medication Errors. *Journal of Nursing Scholarship*, *44*(2), 180-186. doi: http://dx.doi.org/10.1111/j.1547-5069.2012.01443.x
[30]. Ford, D., Seybert, A., Smithburger, P., Kobulinsky, L., Samosky, J., & Kane-Gill, S. (2010).
[31]. Impact of simulation-based learning on medication error rates in critically illpatients. *Intensive Care Medicine*, *36*(9), 1526-1531. doi: http://dx.doi.org/10.1007/s00134-010-1860-2.
[32]. Frengley, R., Weller, J., Torrie, J., Dzendrowskyj, P., Yee, B., & Paul, A. et al. (2011). The effect of a simulation-based training intervention on the performance of established critical care unit teams*. *Critical Care Medicine*, *39*(12), 2605-2611. doi: http://dx.doi.org/10.1097/ccm.0b013e3182282a98.
[33]. Ganeshkumar, P., & Gopalakrishnan, S. (2013). Systematic reviews and meta-analysis: Understanding the best evidence in primary healthcare. *Journal of Family Medicine andPrimary Care*, *2*(1), 9. doi: http://dx.doi.org/10.4103/2249-4863.109934.
[34]. Garrett, B., MacPhee, M., & Jackson, C. (2011). Implementing high-fidelity simulation inCanada: Reflections on 3years of practice. *Nurse Education Today*, *31*(7), 671-676. doi::http://dx.doi.org/10.1016/j.nedt.2010.10.028
[35]. Grant, J., Moss, J., Epps, C., & Watts, P. (2010). Using Video-Facilitated Feedback to Improve Student Performance Following High-Fidelity Simulation. *Clinical Simulationin Nursing*, *6*(5), e177-e184. doi: http://dx.doi.org/10.1016/j.ecns.2009.09.001.
[36]. Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, *26*(2), 91-108.
[37]. Greenhalgh, T. (2014). *How to Read a Paper: The Basics of Evidence-based Medicine*.
[38]. London: Wiley-Blackwell.
[39]. Griswold, S., Ponnuru, S., Nishisaki, A., Szyld, D., Davenport, M., Deutsch, E., & Nadkarni,
[40]. (2012). The Emerging Role of Simulation Education to Achieve Patient Safety. *Pediatric Clinics of North America*, *59*(6), 1329-1340.doi: http://dx.doi.org/10.1016/j.pcl.2012.09.004.
[41]. Grove, S., Gray, J., & Burns, N. (2015). *Study guide for Understanding nursing research*.
[42]. Maryland Heights, Mo.: Elsevier Saunders.
[43]. Hayden, J. (2010). Use of Simulation in Nursing Education: National Survey Results. *Journal of Nursing Regulation*, *1*(3), 52-57. doi: http://dx.doi.org/10.1016/s2155-8256(15)30335-7
[44]. Hegland, P., Aarlie, H., Strømme, H., & Jamtvedt, G. (2017). Simulation-based training for nurses: Systematic review and meta-analysis. *Nurse Education Today*, *54*, 6-20. doi: http://dx.doi.org/10.1016/j.nedt.2017.04.004
[45]. Holly, C., Saimbert, M., & Salmond, S. (2012). *Comprehensive Systematic Review for Advanced Nursing Practice*. Springer Publishing Company.

[46]. Hopp, L., & Rittenmeyer, L. (2012). *Introduction to evidence-based practice*. Philadelphia,PA: F.A. Davis Co.

[47]. Houser, J. (2016). *Nursing research: Reading, using and creating evidence*. Jones & BartlettLearning.

[48]. Hulley, S., Cummings, S., Browner, W., Grady, D., & Newman, T. (2013). *Designing Clinical Research*. Philadelphia: Lippincott Williams & Wilkins.

[49]. Husebø, S., O'Regan, S., & Nestel, D. (2015). Reflective Practice and Its Role in Simulation. *Clinical Simulation in Nursing*, *11*(8), 368-375.doi: http://dx.doi.org/10.1016/j.ecns.2015.04.005.

[50]. Janssen, M., Wimmer, M., & Deljoo, A. (2015). *Policy Practice and Digital Science*. Cham.:Springer.

[51]. Jansson, M., Ala-Kokko, T., Ohtonen, P., Meriläinen, M., Syrjälä, H., & Kyngäs, H. (2014).

[52]. Human patient simulation education in the nursing management of patients requiring mechanical ventilation: A randomized, controlled trial. *American Journal of InfectionControl*, *42*(3), 271-276. doi: http://dx.doi.org/10.1016/j.ajic.2013.11.023.

[53]. Jewell, D., & Jewell, D. (2011). *Guide to evidence-based physical therapist practice*.

[54]. Sudbury, MA: Jones & Bartlett Learning.

[55]. Jones, B., & Potter, C. (2017). Applying Best Practice in Simulation: Critical Care Response Team Training. *Clinical Simulation in Nursing*, *13*(9), 442-445.doi: http://dx.doi.org/10.1016/j.ecns.2017.05.009

[56]. Jonker, J., & Pennink, B. (2010). *The Essence of Research Mmethodology*. Berlin: Springer.Karanikola, M., Albarran, J., Drigo, E., Giannakopoulou, M., Kalafati, M., & Mpouzika, M.

[57]. et al. (2013). Moral distress, autonomy and nurse-physician collaboration among intensive care unit nurses in Italy. *Journal of Nursing Management, 22*(4), 472-484.doi::http://dx.doi.org/10.1111/jonm.12046.

[58]. Khan, K. (2011). *Systematic Reviews to Support Evidence-based Medicine*. London: HodderAnnold.

[59]. Kim, J., Park, J., & Shin, S. (2016). Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis. *BMC Medical Education*, *16*(1), 152.doi: http://dx.doi.org/10.1186/s12909-016-0672-7

[60]. Lewis, R., Strachan, A., & Smith, M. (2012). Is High Fidelity Simulation the Most Effective Method for the Development of Non-Technical Skills in Nursing? A Review of the Current Evidence. *The Open Nursing Journal*, *6*, 82-89.

[61]. doi: http://dx.doi.org/10.2174/1874434601206010082

[62]. LoBiondo-Wood, G., & Haber, J. (2014). *Nursing Research* (8th ed.). Missouri: Elsevier. Lucas, A. (2014). Promoting Continuing Competence and Confidence in Nurses Through High-Fidelity Simulation-Based Learning. *The Journal of Continuing Education in Nursing*, *45*(8), 360-365. doi: http://dx.doi.org/10.3928/00220124-20140716-02.

[63]. Mallett, R., Hagen-Zanker, J., Slater, R., & Duvendack, M. (2012). The benefits and challenges of using systematic reviews in international development research. *Journal of Development Effectiveness*, *4*(3), 445-455.
doi: http://dx.doi.org/10.1080/19439342.2012.711342.

[64]. McKinney, J., Cook, D., Wood, D., & Hatala, R. (2012). Simulation-Based Training for Cardiac Auscultation Skills: Systematic Review and Meta-Analysis. *Journal of General Internal Medicine*, *28*(2), 283-291. doi: http://dx.doi.org/10.1007/s11606-012-2198-y.

[65]. Merriman, C., Stayt, L., & Ricketts, B. (2014). Comparing the Effectiveness of Clinical Simulation versus Didactic Methods to Teach Undergraduate Adult Nursing Students to Recognize and Assess the Deteriorating Patient. *Clinical Simulation in Nursing*, *10*(3), e119-e127. doi: http://dx.doi.org/10.1016/j.ecns.2013.09.004.

[66]. Meurling, L., Hedman, L., Sandahl, C., Felländer-Tsai, L., & Wallin, C. (2013). Systematic simulation-based team training in a Swedish intensive care unit: a diverse response among critical care professions. *BMJ Quality & Safety*, *22*(6), 485-494.
doi: http://dx.doi.org/10.1136/bmjqs-2012-000994

[67]. Modschiedler, C., & Bennett, D. (2014). *Guide to Reference in Medicine and Health*.

[68]. Chicago, IL: ALA Editions.

[69]. Mundi, S., Pindiprolu, B., Simunovic, N., & Bhandari, M. (2014). Similar mortality rates in hip fracture patients over the past 31 years. *Acta Orthopaedica*, *85*(1), 54-59.doi: http://dx.doi.org/10.3109/17453674.2013.878831

[70]. Naik, V., & Brien, S. (2012). Review article: Simulation: a means to address and improve patient safety. *Canadian Journal of Anesthesia/Journal Canadien D'anesthésie*, *60*(2),192-200. doi: http://dx.doi.org/10.1007/s12630-012-9860-z.

[71]. National Health Service. (2012). *Adult Critical Care in England – April 2010 to March 2011: Experimental Statistics*. London, England: The Health and Social Care Information Centre.

[72]. Neergaard, M., Olesen, F., Andersen, R., & Sondergaard, J. (2009). Qualitative description – the poor cousin of health research? *BMC Medical Research Methodology*, *9*(1).doi: http://dx.doi.org/10.1186/1471-2288-9-52

[73]. Neill, M., & Wotton, K. (2011). High-Fidelity Simulation Debriefing in Nursing Education: A Literature Review. *Clinical Simulation in Nursing*, *7*(5), e161-e168.doi: http://dx.doi.org/10.1016/j.ecns.2011.02.001

[74]. Newton, J., Billett, S., Jolly, B., & Ockerby, C. (2009). Lost in translation: barriers to learning in health professional clinical education. *Learning in Health and SocialCare*, *8*(4), 315-327. doi: http://dx.doi.org/10.1111/j.1473-6861.2009.00229.x

[75]. Okuda, Y., Bryson, E., DeMaria, S., Jacobson, L., Quinones, J., Shen, B., & Levine, A. (2009). The Utility of Simulation in Medical Education: What is the Evidence? *MountSinai Journal of Medicine: A Journal of Translational and Personalized*

[76]. *Medicine*, *76*(4), 330-343. doi: http://dx.doi.org/10.1002/msj.20127.

[77]. Parrillo, J., & Dellinger, R. (2014). *Critical Care Medicine: Principles of Diagnosis and Management in the Adult*. London: Elsevier Health Sciences.

[78]. Pascual, J., Holena, D., Vella, M., Palmieri, J., Sicoutris, C., & Selvan, B. et al. (2011). Short Simulation Training Improves Objective Skills in Established Advanced Practitioners Managing Emergencies on the Ward and Surgical Intensive Care Unit. *The Journal of Trauma: Injury, Infection, and Critical Care*, *71*(2), 330-338.doi: http://dx.doi.org/10.1097/ta.0b013e31821f4721.

[79]. Pike, T., & O'Donnell, V. (2010). The impact of clinical simulation on learner self-efficacy in pre-registration nursing education. *Nurse Education Today*, *30*(5), 405-410.doi: http://dx.doi.org/10.1016/j.nedt.2009.09.013.

[80]. Polit, D., & Beck, C. (2010). *Nursing Research*. Philadelphia: Wolters KluwerHealth/Lippincott Williams & Wilkins.

[81]. Qayumi, K., Badiei, S., Zheng, B., Cheng, A., Pachev, G., Koval, V., & Ziv, A. (2014). Status of simulation in health care education: an international survey. *Advances in Medical Education and Practice*, *5*, 457-467. doi: http://dx.doi.org/10.2147/amep.s6545.1

[82]. Rebar, C., & Macnee, C. (2010). *Understanding Nursing Research*. Philadelphia, Pa.:Lippincott Williams & Wilkins.

[83]. Richards, D. (2010). Critically Appraising Systematic Reviews. *Evidence-Based Dentistry*, *11*(1), 27-29. doi: http://dx.doi.org/10.1038/sj.ebd.6400710

[84]. Robinson, B., & Dearmon, V. (2013). Evidence-Based Nursing Education: Effective Use of Instructional Design and Simulated Learning Environments to Enhance Knowledge Transfer in Undergraduate Nursing Students. *Journal of Professional Nursing*,

29(4), 203-209. doi: http://dx.doi.org/10.1016/j.profnurs.2012.04.022.

[85]. Roh, Y., Issenberg, S., & Chung, H. (2012). Ward Nurses' Resuscitation of Critical Patients. *Evaluation & The Health Professions*, *37*(3), 335-348.doi: http://dx.doi.org/10.1177/0163278712466408.

[86]. Roh, Y., Lee, W., Chung, H., & Park, Y. (2013). The effects of simulation-based resuscitation training on nurses' self-efficacy and satisfaction. *Nurse EducationToday*, *33*(2), 123-128. doi: http://dx.doi.org/10.1016/j.nedt.2011.11.008.

[87]. Rohleder, T., Lewkonia, P., Bischak, D., Duffy, P., & Hendijani, R. (2010). Using simulation modeling to improve patient flow at an outpatient orthopedic clinic. *Health Care Management Science*, *14*(2), 135-145. doi: http://dx.doi.org/10.1007/s10729-010-9145-4

[88]. Rudnicka, A., & Owen, C. (2012). An introduction to systematic reviews and meta-analyses in health care. *Ophthalmic and Physiological Optics*, *32*(3), 174-183.doi: http://dx.doi.org/10.1111/j.1475-1313.2012.00901.x.

[89]. Sandahl, C., Gustafsson, H., Wallin, C., Meurling, L., Øvretveit, J., Brommels, M., & Hansson, J. (2013). Simulation team training for improved teamwork in an intensive careunit. *International Journal of Health Care Quality Assurance*, *26*(2), 174-188. doi: http://dx.doi.org/10.1108/09526861311297361.

[90]. Satava, R. (2009). The Revolution in Medical Education—The Role of Simulation. *Journal Of Graduate Medical Education*, *1*(2), 172-175. doi: http://dx.doi.org/10.4300/jgme-d-09-00075.1.

[91]. Sccm.org. (2017). *SCCM / Critical Care Statistics*. *Sccm.org*. Retrieved from http://www.sccm.org/Communications/Pages/CriticalCareStats.aspx

[92]. Scherer, Y., Bruce, S., & Runkawatt, V. (2007). A Comparison of Clinical Simulation and Case Study Presentation on Nurse Practitioner Students' Knowledge and Confidence inManaging a Cardiac Event. *International Journal of Nursing Education*

[93]. *Scholarship*, *4*(1). doi: http://dx.doi.org/10.2202/1548-923x.1502.

[94]. Scholtz, S., Nel, E., Poggenpoel, M., & Myburgh, C. (2016). The Culture of Nurses in a Critical Care Unit. *Global Qualitative Nursing Research*, *3*, 233339361562599. doi:http://dx.doi.org/10.1177/2333393615625996.

[95]. Schroedl, C., Corbridge, T., Cohen, E., Fakhran, S., Schimmel, D., McGaghie, W., & Wayne,

[96]. D. (2012). Use of simulation-based education to improve resident learning and patient care in the medical intensive care unit: A randomized trial. *Journal of Critical Care*, *27*(2), 219.e7-219.e13. doi: http://dx.doi.org/10.1016/j.jcrc.2011.08.006.

[97]. Scully, N. (2011). The theory-practice gap and skill acquisition: An issue for nursing education. *Collegian*, *18*(2), 93-98. doi: http://dx.doi.org/10.1016/j.colegn.2010.04.002

[98]. Sellman, D., Snelling, P., & Sellman, D. (2016). *Becoming a Nurse: Fundamentals of Professional Practice for Nursing*. London: Taylor & Francis.

[99]. Shearer, J. (2012). High-Fidelity Simulation and Safety: An Integrative Review. *Journal of Nursing Education*, *52*(1), 39-45. doi: http://dx.doi.org/10.3928/01484834-20121121-01.

[100]. Smith, J., & Cole, F. (2009). Patient Safety: Effective Interdisciplinary Teamwork through Simulation and Debriefing in the Neonatal ICU. *Critical Care Nursing Clinics of NorthAmerica*, *21*(2), 163-179. http://dx.doi.org/10.1016/j.ccell.2009.01.006.

[101]. Staudinger, B., Hoess, V., & Ostermann, H. (2009). *Nursing and Clinical Informatics*.

[102]. Hershey, Pa.: IGI Global.

[103]. Suresh, S. (2014). *Nursing research & statistics*. Rishikesh: Elsevier.

[104]. Tiffen, J., Graf, N., & Corbridge, S. (2009). Effectiveness of a Low-fidelity SimulationExperience in Building Confidence among Advanced Practice Nursing Graduate Students. *Clinical Simulation in Nursing*, *5*(3), e113-e117. doi: http://dx.doi.org/10.1016/j.ecns.2009.01.009

[105]. Tschannen, D., Aebersold, M., McLaughlin, E., Bowen, J., & Fairchild, J. (2012). Use of virtual simulations for improving knowledge transfer among baccalaureate nursing students. *Journal of Nursing Education and Practice*, *2*(3).

[106]. doi: http://dx.doi.org/10.5430/jnep.v2n3p15.

[107]. Villar, J., Sulemanji, D., & Kacmarek, R. (2014). The acute respiratory distress syndrome. *Current Opinion in Critical Care*, *20*(1), 3-9. doi: http://dx.doi.org/10.1097/mcc.0000000000000057.

[108]. Wayne, D., Didwania, A., Feinglass, J., Fudala, M., Barsuk, J., & McGaghie, W. (2008). Simulation-Based Education Improves Quality of Care During Cardiac Arrest TeamResponses at an Academic Teaching Hospital. *Chest*, *133*(1), 56-61. doi: http://dx.doi.org/10.1378/chest.07-0131.

[109]. Wolf, L. (2008). The Use of Human Patient Simulation in ED Triage Training Can Improve Nursing Confidence and Patient Outcomes. *Journal of Emergency Nursing*, *34*(2), 169-171. doi: http://dx.doi.org/10.1016/j.jen.2007.11.005.