

Efficacy of High-Fidelity Simulation Practice to Improve Intensive Care Unit Qualified Nurses' Confidence in Managing Adult Sedated Patients during End-of-Life Care: A Systematized Review

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Abstract: Background: Understanding the efficacy of High-Fidelity Simulations (HFS) in the management of end-of-life care in Intensive Care Unit (ICU) nursing practice is critical. Different views have emerged in nursing research regarding the place of the efficacy of HFS in determining ICU qualified nurses' management of patients sedated during End-of-Life Care (EOLC).

Methods: The study used a systematized review of existing literature. The CASP tool was used to appraise the methodological quality of the studies.

Findings: HFS demonstrated a high level of confidence among ICU qualified nurses in managing diverse cases during EOLC. Simulation improves the various skills towards patients sedated for the EOLC.

Conclusion: HFS is a useful tool for nurses to deal with the challenges of EOLC. Further research should use randomized controlled trials to investigate the efficacy of HFS in improving the confidence of ICU qualified nurses in dealing with EOLC patients.

Keywords: High fidelity simulations, end of life care, ICU, nursing training, HFS, EOLC

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I. Introduction

Background and Context

This study aims to determine whether High-Fidelity Simulations (HFS) can improve the confidence of qualified nurses. The study targeted the nurses whose responsibility is to manage patients who are sedated during end-of-life care (EOLC). According to Rourke et al., simulation-based education is used as the channel to disseminate knowledge to nursing students in preparation to assume responsibilities of patients in intensive care units (ICUs)(1). Furthermore, a high-fidelity simulator is a critical tool in nursing education(2). According to Al-Ghareebet al., high fidelity human-patient simulation manikins lead to diverse student satisfaction, acquisition of knowledge and clinical reasoning(3). The skills or knowledge determine the extent that a student nurse manages critically ill patients in an ICU(4).

High-fidelity manikins can solve complex care situations in contemporary hospitals. At least 52% of the institutions using HFS to equip students with the confidence, decision-making, and communication skills acknowledge the existence of critical patient(5). The experiential learning created by the integration of manikins should address the morbidity and mortalities registered in critical care environments, such as ICUs. According to Al-Elqet al., medical errors in critical care environments are responsible for 3% of all patient deaths, which translate into 98,000 deaths per year in the USA. Meanwhile, medical errors among qualified nurses have a bigger impact in Saudi Arabia due to education disparities (6). Hence, the acquisition of skills to manage patients sedated during EOLC is critical.

There has been widespread use of HFS manikins in preparing nurses. According to Gateset al., traditional learning experiences lack the capacity to instil the necessary skills that nursing students are expected to possess in order to deal with critically ill adult patients(7). At least 25% of the nursing lessons occur in simulation laboratories in California. The acknowledgment of simulated learning experiences by Gateset al. is proof that HFS is an effective tool for evaluating nurses who deal with diverse critical cases(7). A Cost-utility analysis study recognised the investment in simulated learning environments to increase students' engagement(8). Additionally, it was viewed that as an investment boost to clinical reasoning, knowledge, acquisition and satisfaction of undergraduate nurses.

The analysis by Lapkin et al. demonstrated that decision-makers value economic teaching aids(8). Use of manikins in developed countries to facilitate nursing education is due to its possible impact on consultation skills, self-rated competence, and communication; for instance, in the UK(9). However, the acquisition of

knowledge, skills, and confidence through manikins in addressing critical issues in ICUs is not limited to nursing education⁽⁹⁾ with current evidence shows the wide acquisition of non-technical skills using HFS. According to Lewis et al., non-technical skills are important in dealing with critically ill patients⁽¹⁰⁾. Hence, the use of HFS manikins is due to their potential impact upon communication, teamwork, decision-making, and leadership, as nurses deal with complex care situations.

The perception towards HFS manikins aligns with the wide usage of teaching aids on nursing students. According to Au et al., nursing students have embraced high-fidelity activities as opposed to clinical placements due to perceived resourcefulness⁽¹¹⁾. Role and rote learning through HFS manikins have proven effective in solving misunderstandings relating to complex care situations. Mieure et al. discovered from advanced cardiac life support (ACLS) workshops that the implementation of the human patient simulator is what determines effectiveness⁽¹²⁾. Consequently, the learning experience and retention of knowledge through HFS education in developed countries facilitate nurses' abilities to deal with critically ill patients⁽¹³⁾. The use of high-fidelity manikins has been an integral practice in developing concepts, although this remains a new concept in Saudi Arabian hospitals.

The commitment of the Kingdom of Saudi Arabia (KSA) has been to change the health care sector by introducing revolutionising teaching aids⁽¹⁴⁾. The Saudi Commission for Health Specialties (SCHS) recognised the importance of this, however, the commission lacked an explicit account of how high-fidelity manikins can shape the management of patients sedated during EOLC. According to Netelet al., political, economic, and social controversies in the KSA impede the introduction of simulated learning environments⁽¹⁵⁾. The government has yet to understand the effects of simulation-based training on nurses' self-efficacy, confidence and satisfaction in dealing with complex care situations. According to Roh, et al., simulated learning has proven effective in resuscitation training, which can be transferred to active nursing environments⁽⁴⁾. The KSA has shown a positive perception towards simulation-based medical education⁽¹⁶⁾. Even though there has been the systematic refusal to integrate modern aspects of nursing education, Ahmed et al. agree that the KSA has developed positive attitudes towards the use of simulation⁽¹⁶⁾. Moreover, the complex nature of high-fidelity manikins presented barriers in countries such as the KSA, but dedicated technological support ensures their active use in the curriculum⁽³⁾.

Potential Impact of the Review

Understanding the potential effectiveness of high-fidelity manikins in enhancing the confidence of qualified nurses in managing adult patients sedated during EOLC would inform educational policy changes. According to Bokeret al., SCHS has continued to embrace technical development in the evidence-based medicine⁽¹⁴⁾. A comprehensive, systematic review should affirm its place in the training and assessment of processes for students and registered nurses. In addition, simulation-based medical education facilitates the acquisition of skills, knowledge, and attitudes are required for safe practice and educationally oriented processes⁽¹⁴⁾. Furthermore, Al-Ghareebet al. noticed that current training programs for nurses lack the specific paths to equip skills in intensive care medicine. Accordingly, the findings of the systematic review form the basis for curriculum development⁽³⁾.

Curriculum development in the nursing field is essential, as it can revolutionise teaching and learning⁽⁶⁾. The potential of educational activities in replicating clinical scenarios should promote competence of both undergraduate and post-graduate nurses. The study established that the long-term advantage of using simulated learning is in enabling registered nurses to improve patient safety and reduce care costs⁽⁶⁾. However, the potential of high-fidelity manikins in equipping nurses with the right skills for ICU services cannot be realised without an in-depth review of the current curriculum⁽¹⁷⁾. The systematised review should provide findings that affirm the essence of integrating undergraduate and post-graduate education in preparation for the challenges in real care settings. Conversely, governments, such as in the KSA, will endeavour to eliminate the systematic challenges that frustrate the integration of HFS.

Overcoming systematic barriers towards the use of HFS in the curriculum will require evidence-based facts that affirm the ineffectiveness of traditional nursing education. According to Manevalet al., it has taken the effort of the government to deal with impediments to the implementation of such effective teaching aids⁽¹⁷⁾. Moule et al. argued that the elimination of systematic barriers requires research to affirm the effectiveness of the pedagogic approach⁽¹⁸⁾. Consequently, the curriculum should accommodate the approaches that have been proven through evaluative research. Curriculum development is essential, although Au et al.⁽¹¹⁾ insist upon creating avenues through which nurses' or students' attitudes and perceptions are understood.

The effect of HFS on the confidence of qualified nurses in handling complex care situations should define safety priorities. According to Seaton et al., the use of simulation-based education in health care settings should be a key tool in progressing the safety of critically ill patients⁽¹⁹⁾. However, the achievements of patient outcomes, such as safety, necessitate input of health care recipients and organisations⁽¹⁹⁾. Hence, the

systematized review should demonstrate the extent that health care institutions can achieve their patient-oriented outcomes.

Existing Systematised Reviews

Satisfactory research has not been undertaken in regard to HFS and nursing confidence, despite Al-Ghareebet *et al.* acknowledging the wide use of this teaching aid⁽³⁾. As a result, it has not been possible to ascertain the association between the use of HFS manikins as teaching aids in nursing education and their effect on confidence. The evaluation of HFS in nursing education by Smith *et al.* study and focused on the correlating outcomes with the satisfaction and self-confidence of student nurses⁽²⁰⁾. A follow-up survey by Buckley *et al.* evaluated the ability of registered nurses to respond to critical patients after undergoing immersive simulation education, as well as high-fidelity simulators⁽²¹⁾.

Buckley *et al.* studied thirty-eight registered nurses practising simulation. However, the survey acknowledged HFS experiences but failed to demonstrate the usefulness of HFS manikins⁽²¹⁾. Nonetheless, the same study provided useful statistics regarding the use of HFS in at least 164 critical patients' emergencies. On the other hand, the lack of confidence-related nursing experiences was the focus of Yuan *et al.* study despite it focusing on the students' confidence and competence during nursing practice⁽²²⁾. The review supported the notion of students gaining immense confidence and building their competence guided by the use of HFS. It validated the effectiveness of the use of simulations in the same manner that Buckley's study did, although it could not affirm the transferability of the simulation experience to qualified nurses^(21, 22).

Another review in 2011 associated HFS with the ability to replace the traditional clinical learning experience in at least 25% of the nursing education centres⁽⁷⁾. The research validated the views of Yuan's study of the same year regarding the efficacy of simulated learning experiences on students' performances⁽²²⁾. However, the research area analyzed by Gates *et al.*⁽²²⁾ further revealed that research had not determined the way that HFS manikins could be the path to improve the confidence of qualified nurses. Yuan *et al.* research undertook a more in-depth systematized review, as opposed to the quantitative study by Gates' study but could not demonstrate the way HFS manikins impacted confidence.

The influence of HFS manikins on confidence in managing patients during EOLC has been an elusive subject. The only acknowledgment relates to the effect of HFS manikins on the critical thinking and clinical decision-making skills among novice nurses⁽¹⁷⁾. Another systematized review by Lapkin *et al.* affirmed the increasing effectiveness of nursing students by using simulation manikins⁽⁸⁾. Correspondingly, the current systematic review aims to address the gap regarding how HFS manikins can improve the confidence of qualified nurses who manage adults' patients sedated during EOLC.

Current studies acknowledge the connection between knowledge, skills, competence, and the performance of the nurses, but without focusing on purely critical care. A study by Melnyk *et al.* in 2014 realised that practising registered nurses and nurses in advanced practice are the custodians of quality, reliability, costs, and overall patient outcomes⁽²³⁾. Additionally, the Delphi survey utilised Evidence Based Practice (EBP) mentors in the USA to provide clarity on how competence, skills, and diversified knowledge are integral components in accomplishing patient outcomes. A similar survey by Fulbrook *et al.* in 2012⁽²⁴⁾ was more categorical to ICU nurses in Europe than what was shown by Melnyk *et al.* study⁽²³⁾. However, the study confirmed that knowledge levels increased patient outcomes' scores in areas such as ventilation. Hence the contribution of knowledge, skills, and competence of 1142 European ICU nurses developed the ultimate performance portfolio in 318 ICUs⁽²⁴⁾.

A competency evaluation and quality improvement process among nurses in renal replacement therapy helped Graham *et al.* in 2011⁽²⁵⁾ create programs that increase patient outcomes. Even though the research lacked an empirical framework, it emphasised nursing resources to maximise continuous renal replacement modalities. However, the resources and attention among nurses should be higher when dealing with sedated patients during EOLC⁽²⁶⁾. Moreover, Tingsviket *et al.* noted that the performance level of ICU nurses required the accurate application of knowledge, skills, and competence, due to the risky nature of mechanically ventilated patients. Nonetheless, even though Tingsviket *et al.* and Graham *et al.* stipulated the requirement for performance in ICUs, the use of HFS as a factor to improve the competence, confidence and overall performance of ICU nurses is lacking in their studies^(25, 26).

Insufficient research into existing systematic reviews on whether the use of HFS manikins improve the confidence of ICU qualified nurses charged with managing adult patients who are sedated at the end of life creates the need for the following review question:

"Does high fidelity simulation improve ICU qualified nurses' confidence in managing adult patients who are sedated at the end-of-life?"

Objectives

The specific outcomes of the systematized review were achieved through the following objectives.

- i. To establish the scope of HFS practice in building the confidence of qualified nurses in managing adult patients sedated during EOLC;
- ii. To determine the effectiveness of high-fidelity simulation practice manikins on the competence of qualified nurses, based on their use of skills to manage adult patients sedated during EOLC;
- iii. To understand the clinical benefit of nurses' increased knowledge, skills, and competence resulting from HFS manikins in real life situations.

II. Methods and Analysis

Research Methodology

An EBP methodology was used to determine whether HFS improves the confidence of ICU nurses in managing patients who are sedated during EOLC. EBP enabled nurses to gather evidence that could be useful in solving complex care issues⁽²⁷⁾. The ultimate aim of EBP is to influence decision-making and implementation of methods that improve health care outcomes for patients⁽²⁸⁾. However, the method was useful in nursing research, as it prompted the gathering of evidence that could answer the main research question⁽²⁹⁾. Appraisal of the available evidence is essential in helping health care professionals understand diverse patient problems.

Evaluating existing research reduces cost and time when compared to other quantitative approaches⁽³⁰⁾. EBP ensured that the evaluation of existing evidence was within the body of knowledge published by the researchers who understand the relationship between HFS and the confidence of qualified nurses dealing with sedated adult patients during EOLC⁽²⁹⁾. Additionally, nursing research necessitates the use of methods that facilitate the production of new knowledge or validation of existing facts⁽²⁷⁾. According to Krause-Parello *et al.*, seeking knowledge from existing studies helps the evaluation and distillation process of information to answer research questions⁽³¹⁾.

In addition, EBP necessitates collaboration with professional opinions, although in the present study it was imperative to disseminate the knowledge generated from the existing studies to accomplish the research objectives⁽²⁹⁾. Hence, determining the way HFS builds the confidence of qualified nurses in ICUs required a multifaceted methodology, which prompted effective evaluation of evidence⁽²⁸⁾. The requirement to individualise evidence to meet the aspirations of the research required a method that prompts verification, assessment, and corroboration of data from multiple sources⁽³⁰⁾. The evidence gathered from research documentation should demonstrate the appropriateness, validity and accuracy of the findings⁽³¹⁾. Hence, a systematic review was chosen as the primary research design.

Research Design

A systematized review was used as the main research design to facilitate gathering of relevant evidence. According to Webb *et al.*, systematized reviews enable researchers to evaluate different studies, in order to determine their usefulness within nursing practice⁽³²⁾. Systematized reviews require the formulation of a research question and the use of a critical appraisal of relevant research to answer it⁽³³⁾. Overall, this research design was selected to enable the review to ascertain diverse perceptions from validated researchers.

A systematized review necessitates explicitness and transparency⁽³²⁾. Therefore, it was imperative for the research to appraise available and replicable evidence. The method involves more than a basic identification and discussion of relevant studies⁽³³⁾. Conducting the search process for the relevant studies was imperative, as it enabled the study to establish the diverse views on HFS' correlation with the confidence of qualified nurses dealing with ICU patients. Accordingly, Booth *et al.* recommended a structured process and component steps for the systematic review process used in the study.

A systematized review was chosen as the primary research design, in order to enable the assessment and synthesis of the findings from existing studies⁽³³⁾. The ability to draw conclusions guided by different resources ensures that the research achieves its objectives with a high degree of accuracy and validity⁽³³⁾. Additionally, the comprehensive search process was effective in prompting a quality assessment of the results that addressed the main research question, in accordance with the recommendation of⁽³⁴⁾.

A Systematized Review versus a Systematic Review

The review was different from usual systematic reviews that are conducted during nursing research, as it utilized a systematized review. According to Grant *et al.*, a systematized review includes elements from a systematic review process, but the resultant output is different. The systematized process is meant for postgraduate research, but it does not use the resources required for a comprehensive systematic review, such as the involvement of two reviews⁽³³⁾. Consequently, a systematized review entails independent research to appraise the relevant resources relating to HFS' ability to improve the confidence of qualified nurses managing critical patients.

The comparative strength of systematised reviews and systematic reviews is varied. The evidence used in the systematic review accommodates the study design that oversees the compilation of evidence using mixed,

qualitative, and quantitative approaches. Accordingly, the outstanding element of a systematic review is a critical assessment of the available evidence⁽³⁴⁾. Contrastingly, using a systematised review was imperative, as the expected assessment and critical review is on a higher degree than a systematic review.

The process involved more than cataloguing the included studies, as is conducted in systematic reviews⁽³³⁾. Hence, studies were searched and retrieved from more than one database before they were coded and analysed to meet the expected outcomes. Moreover, the systematised review formed the basis for further extensive work in case the search failed to answer the set research question. However, the systematised review's design factors showed the weaknesses it posed to the study. Meanwhile, the identification of the quality assessment and synthesis is complicated, but a review focuses on a critical appraisal to accomplish the research objectives⁽³³⁾. Additionally, the current review was prone to bias, due to the systematised guidelines, as opposed to systematic review procedures. The reviewer analysed the studies in line with the study objectives only to reduce bias⁽³⁵⁾.

A scoping and critical approach was used to appraise the relevant studies. The systematised approach required predetermination of selection criteria and the development of objectives, which structured the appraisal of the relevant articles⁽³⁶⁾. Furthermore, a systematic search necessitated the development of important keywords in linewith the research question. Indeed, developing a clear and well-defined research question was essential; while a PICO framework was used to identify the research question⁽²⁹⁾.

Identifying the Research Question

Identifying the main research question involved checking other reviews⁽³⁷⁾ to avoid duplication is necessary foran excellent systematised review which necessitates a good research question that states all the variables for the study⁽³⁸⁾. Interrogative and researchable elements were given the priority in the formulation process, as recommended by Butler *et al.*⁽³⁹⁾. The following research question was developed following extensive consultations of existing reviews or studies.

"Does high fidelity simulation improve intensive care unit qualified nurses' confidence in managing adult patients who are sedated during end-of-life care?"

The PICO (Population, Intervention, Comparison, and Outcome) framework assisted in framing the research question. The model simplified the retrieval of the relevant search by separating a question into manageable terms or keywords⁽⁴⁰⁾. This enabled the review to develop objective parameters, which formed the foundation for a well-articulated research process. According to Hastings *et al.*, an effective literature search process in various databases requires practicable medical keywords or statements. Table 1 below contains the breakdown of the research question in a PICO Framework⁽⁴¹⁾.

Table 1: PICO Framework

P (Population)	ICU Qualified Nurses (Adult Patients)
I (Intervention)	High Fidelity Simulation for ventilated or sedated patients during EOLC
C (Comparison)	Qualified nurses without the knowledge or skills in HFS
O (Outcome)	Improved confidence of qualified nurses in managing patients who are sedated during EOLC

Search Strategy

The search strategy was an integral component of the systematised review. The correct level of planning was essential in searching for the relevant studies, as advised by Moher *et al.* (42). An impactful systematised review depends on a thorough search process. Furthermore, the review endeavoured to ascertain the relevant journals to facilitate a comprehensive appraisal (43). The search process focused on published and peer-reviewed articles that addressed the phenomena under review. The screening process correlated with the research question and context of the study. Therefore, the search strategy required the use of medical and nursing databases.

Databases used in the search process

Searching relevant journals requires the accurate location and selection from the medical and nursing databases⁽⁴⁴⁾. The databases include PubMed, CINHALL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Library, Google Scholar, and Ovid. However, the strategies for searching the literature from each database were different to the extent of the required adjustments of the keyword combinations⁽⁴³⁾. Determining and highlighting the content of the studies was essential as well. The search process avoided bias or preference for any journal article, and thus, the overall systematised review used accurate, as well as appropriate literature.

Search process

Developing the relevant keywords simplified the identification of the journal articles from the PubMed, CINAHL, Ovid, Cochrane Library, and Google Scholar. A comprehensive search process aimed to generate an

assortment of journal articles related to the phenomena under review. The process used the keywords generated using the PICO Framework⁽⁴³⁾. The explicit description was in line with the research question, which helped to ascertain vast and appropriate literature. The keywords that defined the search process include: “high fidelity simulation,” “high fidelity manikins,” “confidence,” “knowledge,” “skills,” competence,” “qualified nurses,” “sedated patients,” and “simulation of end-of-life patients.” Boolean Operators “AND” and “OR” were used in the search process to combine the keywords, in order for them to inform an objective search in the five databases.

Inclusion and Exclusion Criteria

The inclusion and exclusion were procedural in order for the search process to minimise selection bias associated with systematized reviews. The criteria considered the study population, research design, interventions, search questions and measured outcomes. Table 2 is a summary of the inclusion and exclusion criteria used to select studies in preparation for the rigorous literature search.

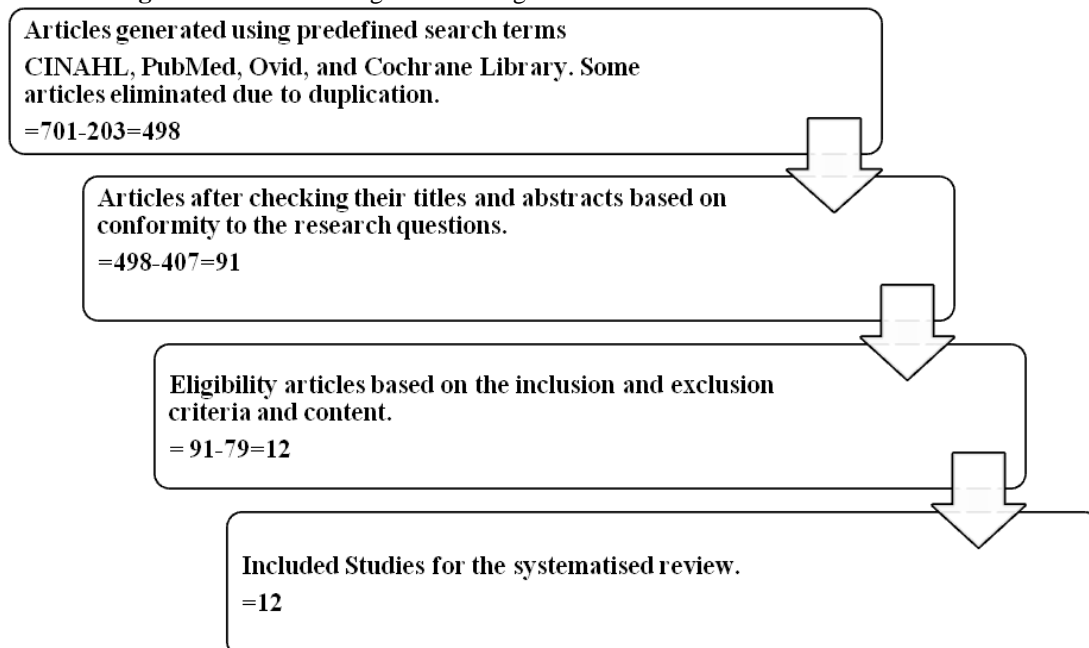
Table 2: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
- Evaluated high-fidelity manikins among qualified nurses.	- Failed to address high-fidelity manikins and their capacity to improve the confidence of ICU nurses.
- Addressed the improvement of qualified nurses' confidence in managing sedated patients during EOLC.	- Lacked express evaluation of the ICU nurses' confidence in managing sedated patients during EOLC.
- Are less than 10 years old (Published between 2008 and 2018).	- More than 10 years old (Published before 2008).
- The journals are peer-reviewed.	- Lack of peer reviews.
- Written in English.	- Written in other languages instead of English.

Search Outcomes

The search from the five databases generated 701 studies, while the screening of the generated studies facilitated the removal of 203 duplicates. The duplicates did not address the research question after examination of their abstracts. Only 91 studies met the inclusion and exclusion criteria after a thorough screening process. Checking the remaining journal articles for eligibility necessitated the examination of the full texts. Subsequently, only 12 articles met the eligibility based on the full-text analysis. Figure 1 below is a PRISMA diagram that shows the classification of the journal articles generated from the databases.

Figure 1: PRISMA Diagram Showing the Classification of the Generated Studies



Quality Appraisal and Evaluation of Selected Studies

Quality appraisal and evaluation of the chosen studies was an essential stage of the systematised review⁽⁴⁵⁾. The CASP (Critical Appraisal Skills Program) tool was used to provide the checklist required for the review. CASP enabled the review to appraise studies for their methodological quality irrespective of the design

used; likewise, the tool provides guidelines on how to undertake the review of the selected literature. CASP provided a checklist to appraise the randomised control trials (RCTs), systematic reviews, cohort studies, case-control research, and qualitative studies⁽⁴⁵⁾. Appendix I shows the comprehensive appraisal of the studies, as required by the CASP framework that is explained by Houghton *et al.*⁽⁴⁶⁾ and CASP UK⁽⁴⁷⁾. CASP helped in the appraisal by ensuring the study answered the following fundamental questions.

1. Are the results of the studies valid?
2. What are the results?
3. Will the results help locally?

Data Synthesis

The systematised review applied a thematic analysis to extract overarching themes from the 12 studies as recommended⁽³³⁾. Hence, reading the material components of each study was crucial. Thematic analysis simplified the narrative synthesis and presentation of findings.

Overview of the Characteristics of the Identified Literature

The search strategy and selection process generated 12 articles, which formed the basis for the final review; Appendix II outlines the characteristics and details of the studies. Some of the characteristics that were identified include the country, research setting, sampling method, the methodology used, data collection, data analysis, ethical discussion, and the name of the journals where the articles were published. The matrix further includes a column on the way that the studies relate to answers for the research question, in order to ensure the selected journal articles met the aims and objectives of the systematised review.

Methodological Quality

Ten of the articles used quantitative methodology^(21, 48-56); while two studies adopted a mixed methods approach^(57, 58). The systematised review relied on the CASP framework to determine the appropriateness of the methodologies chosen for each study. Hence, CASP facilitated the determination of construct validity, which prompts inquiry into the ability of the methods in addressing the constructs under research⁽⁵⁹⁾. The appraisal of all the 12 articles revealed that the methodologies selected were appropriate for the research question or objective.

Wolfet *al.* used a retrospective ED chart review as the best method to determine the effectiveness of clinical simulation on the skills of registered nurses while Barsuk *et al.* applied a more comprehensive quantitative methodology in the form of an observational cohort study to establish the effect of the simulation-based master on the reduction of complications in ICUs^(48, 49). Buckley *et al.* opined that using a survey design would help to determine the usefulness of simulation in cementing nurses' ability to respond to critical clinical emergencies. Separately, Cooper *et al.* executed an exploratory performance review, which bordered the qualitative review⁽⁵⁰⁾, but collected data on nurses' simulated scenarios to affirm their confidence in addressing acute myocardial infarction (AMI), chronic obstructive pulmonary disease (COPD) and primary diagnosis. Additionally, Falcone *et al.* relied on web-based core curriculum trauma and simulation scenarios to answer questions on the use of HFS in trauma on the confidence and skills of a multidisciplinary paediatric team⁽⁵¹⁾.

Hunt *et al.* used a more complicated method than Falcone *et al.* by utilising a prospective pre-post interventional study of residents to determine their competence in handling simulated cardiopulmonary arrests^(51, 52). Meanwhile, Sharp *et al.* expended a simple survey to determine the effect of simulation in an acute care setting, and the subsequent influence upon clinical competence of nurses⁽⁵⁴⁾. Stocker *et al.* exhausted the rigid framework of prospective, single-centre, and longitudinal studies to assess the influence of HFS on the confidence of a team working in a paediatric ICU⁽⁵³⁾. Conversely, Kane *et al.* utilized a survey⁽⁵⁵⁾, in the same manner that Sharp *et al.*⁽⁵⁴⁾ used to determine the influence of HFS training on paediatric ICU nurses' abilities to perform effective cardiovascular resuscitations. Figueroa *et al.* customised their quantitative approach into a course to determine the effectiveness of simulation teamwork, confidence, and the collaboration of paediatric nurses⁽⁵⁶⁾.

The appraisal established the use of a mixed methods approach, which relied on an extensive framework, in comparison to the quantitative studies. For example, Wayne *et al.* combined a retrospective and case-control study that would help to establish solid findings on simulation-based education on the improvement of the quality of care rendered by nurses in cardiac arrest situations⁽⁵⁷⁾. On the other hand, Dowson *et al.* expended a different mixed methods approach in the form of a Quasi-experimental longitudinal approach with mixed methods. That particular study facilitated the evaluation of simulation technologies that have improved clinical confidence among nurses working in paediatric units⁽⁵⁸⁾.

Using both quantitative and qualitative methods enabled the studies to create a solid framework to answer the research questions when compared to the quantitative approaches, which relied on a single source of data. The design allows researchers to execute a transformative approach that utilises a theoretical framework

and cements it through the use of empirical data⁽⁶⁰⁾. Subsequently, the studies showed the breadth and depth of the way HFS structures the confidence of nurses who deal with patients during EOLC. A quantitative framework served as a corroboration tool for the qualitative design integrated into the two studies, which utilised a mixed methodology approach⁽⁶⁰⁾. However, the appraisal determined that studies by Wayne *et al.* in 2008 and Dowson *et al.* in 2013 required more time and resources to implement^(57, 58), which is one of the weaknesses of a mixed method design. The studies did not demonstrate how they resolve the discrepancies associated with the interpretation of the findings for a qualitative and quantitative approach, which is a weakness⁽⁶¹⁾.

Quantitative research used in the ten studies capitalised on the strengths observed through the appraisal. For example, various studies factored the use of many subjects to generate generalizable findings⁽⁵²⁻⁵⁶⁾. Using a quantitative approach might have only exposed the studies to merely narrow theoretical concepts, but it promoted the objectivity and accuracy of the results⁽⁶²⁾. Additionally, the studies avoid the element of personal bias, which is a predominant weakness associated with qualitative research design⁽⁶²⁾. However, the results were limited to the numerical descriptions that failed to employ a detailed approach, as Wayne's study in 2008 and Dowson's one in 2013 performed^(57, 58). The element of HFS' impact upon the confidence of registered nurses necessitated a perspective that could facilitate the measurement of human behaviour and conduct in natural settings.

The studies further employed diverse data collection methods by capitalising on their strengths, rather than their weaknesses with studies using a survey methodology^(52, 54, 55), which ensured that the studies had high representativeness, convenient data gathering, and good statistical significance, despite using an inflexible design, as Ponto *et al.* recommended⁽⁶³⁾. Conversely, the literature utilised questionnaires as the main tools for data collection^(21, 50, 53, 56, 58). The literature benefited from the cost-effectiveness, practical-nature, and generation of speedy results from the questionnaires⁽³⁰⁾. Furthermore, one of the studies⁽⁵⁸⁾ increased the scalability of the data collection by incorporating semi-structured interviews. Consequently, the study gathered data from a large audience, which Polit *et al.* associated with the ability to increase representativeness and generate generalizable findings.

Some of the studies customised their data collection methods, as opposed to using prescribed tools. Barsuk *et al.* reasoned that using a simulator-trained group would maximise the insights into the way high HFS structures the confidence of nurses dealing with patients during EOLC. However, the study lacked a clear procedure to gather insights and exposed itself to control and manage issues within the group framework. On the other hand, the use of videotaped sessions by Falcone *et al.* established a permanent record for future reference and a solid way to determine the interactions between the subjects and the environment, as per the perception by Asan and Montague in 2014^(30, 51, 64). Therefore, the confidence of the registered nurses in the emergencies could be derived from the cues, although the transcription of the videos necessitated time and resource commitment.

The use of logs and entry charts was imperative by many studies^(48, 57). These studies factored the role of data in research and the easy retrieval of information for future use by using logs and entry charts. Correspondingly, the historical association between the nurses and the critical care patients can be determined using the logs and entry charts. However, choosing the data collection approach reduced the representativeness of the information that the study could collect. Gregory *et al.* argued that only medical or clinical professionals can fill the hospital logs and entry charts, which compelled the investigator to have limited influence⁽⁶⁵⁾. Consequently, both Wayne and Wolf studies had to make follow-ups to ensure that the data was in line with their research expectations and framework.

The studies focused to include the participants, rather than excluding them. The literature used different samples, but they were representative of the extent of ensuring the findings from each sample were generalizable to the target population. However, Dowson *et al.* and Wolf selected a small sample size of 20 and 13, respectively, when compared to other studies that chose at least 30 participants^(48, 58). The sample size conflicted with their quantitative survey methodologies, which depend on a large audience to achieve representativeness.

Other studies^(21, 49, 57, 58) utilized positive control groups which enabled them to eliminate bias and external influence to generate strong bias, as Pithon recommends⁽⁶⁶⁾. Barsuk *et al.* aimed to use the intervention group as the basis to ascertain the effectiveness of simulation-based education among internal medicine and emergency medicine residents' capability to manage complications of central venous catheters in medical ICUs with high self-confidence. Separately, Buckley *et al.* used a control group for a follow-up survey aimed at determining the effect of immersive HFS training on the registered nurses' ability to deal with deteriorating patients. Meanwhile, Dowson *et al.* adopted a simplified execution of control groups, as the experimental study aimed to establish in-situ simulation's effects on the clinical confidence of paediatric nurses after receiving zero training. The case-control of Wayne *et al.* compared non-training residents and residents who received simulation education.

The studies factored the role of ethics in research, which exemplify the moral and social values, including social responsibility, compliance with the law, human rights and public safety⁽⁶⁷⁾. The studies

addressed the critical ethical issues regarding seeking approval, informed written consent, anonymity, and confidentiality of the research. The researchers understood the investigation of involving concepts, such as simulation and human behaviours; for instance, the confidence of registered nurses that could present ethical lapses. However, demonstrating and discussing ways of preventing any physical, psychological, or emotional harm to human subjects is vital⁽⁶⁸⁾. Eleven studies followed the norms required to demonstrate acceptable behaviour in research, in order for the findings to reflect high accountability to the public or registered nurses. However, Sharp *et al.*⁽⁵⁴⁾ lacked an explicit discussion of ethics, despite conducting a study within a hospital setting. The study lacked the important elements of autonomy, respect for human dignity.

The majority of the studies were conducted in medical institutions in the USA, while others exploited clinical environments in the UK. Therefore, the studies had an international scope, which improves the relevance of the findings and minimises bias. Even though the locations were limited to developed countries, they provide extensive experience in relation to the use of simulation to define the conduct of registered nurses managing critical patients. In particular, researchers consider geographical specificity as an important component in the generalisation and replication of the outcomes to similar locations.

The CASP tool prompted the appraisal of the findings' credibility from the 12 studies. The question enabled the study to evaluate the quality of the statement of the findings from each study^(69, 70). One of the indicators noted in the appraisal of the methodology quality was the interrater reliability used in studies such as Barsuk *et al.* and Wayne *et al.*^(49, 57). The function affirmed the attempt of the quantitative and mixed methods studies to ensure the reliability and objectivity of the findings. Therefore, the researchers avoided the personalities, beliefs, and values that could have impeded the achievement of the objectives⁽⁷⁰⁾.

The deployment of the interrater reliability component was not uniform in all studies, but it shows that the investigators understood the essence of evaluating the judgements from the perspective of different participants in accordance with Voss *et al.* in a 2012 study⁽⁷¹⁾. The literature achieved a high level of validity to define and operationalize the objectives and goals, as per the stated methodologies recommended by Heale *et al.*⁽⁷²⁾.

Overall, studying the efficacy of HFS practice in the improvement of ICU nurses' confidence in the management of patients sedated during EOLC was a complex topic. Each study presented a model or design that ensured the control and accountability for all variables. None of the literature relied on past studies as the basis for research, which improved the empirical framework deployed in the research. The studies accounted for the research ethics involved in their investigations, considering that every methodology relied on the input of the human participants to generate their findings. Consequently, the overall quality of the methodologies deployed in the current study is high.

Summary of Findings

The 12 studies addressed the efficacy of HFS in improving ICU nurses' confidence in managing patients sedated during EOLC. The association between the mastery of simulation-based skills and the reduction of the complications during the insertion of the central venous catheter in medical ICU was the theme of Barsuk *et al.* research. The study was extensive, as it compared the mastery of internal medicine and emergency medicine residents who received simulation-based education and another intervention groups that did not undertake similar training. The study relied on the comparative analysis and corroboration due to the incorporation of a control group. Barsuk *et al.* found that simulation-based mastery in catheter insertion reduced complications by 70.3%, while the residents who did not undergo training showed insignificant improvements. The findings were limited to catheter insertions against other ICU related complications but confirmed similar findings by Cassell *et al.* on the requirement for nurses to reduce intractable suffering for sedated patients⁽⁷³⁾.

Buckley *et al.* limited their study to clinical emergencies for medical registrations, as with Barsuk *et al.*^(21, 49). However, the primary interest of the research was the effectiveness of using HFS, which overcame the need for mastery. Buckley *et al.* argued that dealing with acutely deteriorating conditions requires medical nurses to demonstrate a significant ability to actualise the theory learned in simulation classes. The study showed that medical and surgical registered nurses handled 46% cardiac, 7% electrolyte disturbances, 7% cardiac arrests, 32% respiratory emergencies, and 10% neurological cases, which required skills in systematic handling handover, and airway management. Hence, the findings by Buckley *et al.* reflected extensive research that could assert the role of HFS in improving the effectiveness and subsequent confidence of nurses. The findings failed to acknowledge the challenges confronting the nursing role in EOLC, which Efsthathiou *et al.* determined⁽⁷⁴⁾. Nevertheless, they agreed with Buckley *et al.* that the implementation of recognised care planning frameworks necessitates accurate skill application by nurses.

Dowson *et al.* were more categorical than Buckley *et al.*, as that study focused on the association between in-situ simulation and confidence of clinical nurses. Anchoring the study on a mixed method approach enabled the research to generate results on how qualified nurses managed paediatric emergencies using simulation with a high level of confidence^(21, 58). According to Dowson *et al.*, simulation training improved the confidence of nurses dealing with critical paediatric care; the confidence level was noted in both the pre- and

post-clinical stages⁽⁵⁸⁾. However, the sustainability of the confidence in palliative sedation situations depends on the correct assessment and ethical decisions⁽⁷⁵⁾. Zinn *et al.*⁽⁷⁶⁾ added that confidence depends on the perceptions towards patients sedated at the end-of-life and communication skills, rather than administration of simulation skills, as Dowson *et al.* found⁽⁵⁸⁾.

Falcone *et al.* studied the efficacy of HFS from the perspective of the multidisciplinary nursing team dealing with trauma issues⁽⁵¹⁾. Moreover, adopting a multidisciplinary approach factored the generalizability of the findings. Both early groups and late groups of trauma care nurses registered 65% and 75% improvements, respectively, in the assessment, airway management, and administration of cervical spine care. The study, however, failed to factor the element of sedation at during EOLC, although Falcone *et al.* showed the extent of innovative technology, such as how HFS can be critical in the improvement of performance of multidisciplinary teams in ICUs⁽⁵¹⁾. The acknowledgement of innovative technology by Falcone *et al.* were complemented by the findings of Wilkie *et al.* in 2012⁽⁷⁷⁾, who found it as an essential component of pain and symptoms management in different situations presented by patients sedated during EOLC. Therefore, the management of sensitive patients necessitates nurses to factor the multidimensional experiences and use the knowledge or skills they have gained to deal with complications that arise.

Figuroa *et al.* in their study in 2012 agreed with Falcone *et al.*'s study in 2008 that the assessment of the efficacy of simulation-based training should be evaluated from a multidisciplinary perspective^(51, 56). Both studies focused on the nurses dealing with paediatric cardiovascular ICUs to understand how the incorporation of simulation training improved confidence, teamwork and collaboration. Hence, confidence was not an isolated outcome, as Dowson *et al.* demonstrated one of the benefits that the registered nurses stood to gain in their management of cardiovascular, paediatric emergencies⁽⁵⁸⁾. However, the administration of simulation skills depends on the alignment of the attitudes and practice of the nurses, particularly in sedation situations⁽⁷⁸⁾. Additionally, Abarshiet *et al.* in 2014 showed that Dowson *et al.*'s 2013 study should have factored that the perception of nurses was critical in the improvement of confidence and teamwork, due to the acquisition of simulation skills. Dealing with critical cardiovascular ICU issues requires simulation-based teamwork formulated through confidence, communication and aligned perceptions to reduce morbidity and mortalities.

Hunt *et al.* in 2014 study focused on resident resuscitation skills, instead of the multidisciplinary aspects of acquiring and using simulation skills in critical care settings⁽⁵²⁾. The study exploited the inability of the previous studies in establishing the role of simulated resuscitation experiences on the residents' skills in administering care in critical situations. Hunt *et al.* customised the simulation-training program, referred to as Rapid Cycle Deliberate Practice (RCDP), as opposed to limiting themselves to the prescribed simulation education, as Figuroa *et al.* did in their 2012 study^(52, 56). Consequently, the researchers found significant improvements in the undertaking of defibrillation and managing the initiation of compressions after the commencement of pulseless ventricular tachycardia. The findings exemplified critical acquisitions of skills and effectiveness necessary for cardiovascular care. Moreover, Adams *et al.* in 2014 opined that the risk nature of ICU patients requires communication and teamwork⁽⁷⁹⁾. Correspondingly, Holms *et al.* ascertained from the lived experiences of nurses that adequate preparation is imperative for nurses who deal with EOLC in ICUs⁽⁸⁰⁾.

The findings by Kane *et al.* in 2011 correlate with the views of Holms *et al.* in 2014 on the need to manage critical patient issues by using programs, such as simulations^(55, 80). That study of the simulation program enabled nurses in paediatric cardiac ICUs to rethink their resuscitation skills, which improved their perceptions towards patients in ICU units. Even though the study relied on the analysis of subjective self-reports, Kane *et al.* affirmed the essence of using simulations to oversee the performance of actual resuscitations, which were factors in increasing the confidence of the nurses. However, Jeffers *et al.* argued that deeper knowledge and understanding superseded the performance of issues, such as cardiac arrests for patients during EOLC⁽⁸¹⁾. Similarly, although Jeffers *et al.* argued from the perspective of undergraduate nursing students, they determined that the effectiveness of using nursing skills to manage sensitive care issues should be a top priority⁽⁸¹⁾.

The findings by Sharp *et al.* in 2014 focused on the relationship between HFS and the management of acute care by nurses in hospitals in the USA⁽⁵⁴⁾. Although the study lacked an explicit account of how the influence of simulation directs EOLC, it affirmed that self-confidence alone cannot be the ultimate determinant of nurses' behaviour or demonstration of confidence. Instead, Sharp *et al.* found work satisfaction to be as imperative as the confidence of the nurses working in acute inpatient settings⁽⁵⁴⁾. The investigation implied the ability of HFS to improve confidence across all nursing levels, which comprises of staff members managing patients sedated during EOLC. However, Olsen *et al.* found that confidence and competence should be viewed from the larger perspective of ethical decision-making during EOLC to facilitate the withdrawal or withholding of life-sustaining treatments⁽⁸²⁾.

Stocker *et al.* in 2011 undertook a more extensive longitudinal study than Sharp *et al.* did in 2014, but the findings aligned with the effect of embedded simulation on the performance of nurses^(53, 54). The investigation involved a larger team of multidisciplinary health professionals who participated in the simulation

sessions, as opposed to the analysis of nurses' outcomes, as other studies conducted^(55, 58). However, Stocker *et al.* realised that 72.7% of the health professionals gained confidence in dealing with critical care nursing cases after undergoing the 6-12-month simulation program. Hence, the exposure to the acquisition of skills that could help in the ethical decision-making or treatment of the sedated patients during EOLC was clear, despite Stocker *et al.* failing to explicitly address this. Furthermore, Papavasiliou *et al.* argued that the implementation of skills in the management of sedated patients is critical as the challenges evolve over time⁽⁸³⁾. Meanwhile, Stocker *et al.* affirmed the sustainability of confidence and performance of health professionals in varied critical care environments⁽⁵³⁾.

Cooper *et al.* in a 2011 study was more categorical than Stocker *et al.* study was^(50, 53), as both studied the management of deteriorating patients by nurses who underwent simulation training. The study opined that the nurses' ability to perform well for patients needing critical care required platforms where they can develop their skills. Cooper *et al.* undertook an exploratory performance review and found that nurses who underwent simulation had confidence and significant knowledge on how to manage patients with AMI and COPD. However, Cooper *et al.* noted a high-risk factor in the deteriorating patients' management, due to the section of nurses who acquired below 27% in the simulation of knowledge and skills⁽⁵⁰⁾. The findings reflect the assertions by Liaw *et al.*'s study which argued that the transference of simulated skills necessitates self-direction and the sufficient association with the realism associated with real-life clinical experiences, such as sedated patients during EOLC⁽⁸⁴⁾.

The ability to transfer skills was an integral concept in another study by Wayne *et al.* in 2008⁽⁵⁷⁾. Even though the study focused on the quality of care developed from simulated cardiac arrest situations in an academic teaching hospital, the residents showed high standards when using simulation lessons. However, Wayne *et al.* implied that the improvements and execution of the skills are more effective in a teamwork based environment, as opposed to the individualised situation⁽⁸⁴⁾. At least 68% of the residents who participated in the simulator training improved the quality of care administered to patients when compared to the low score among residents who followed traditional approaches of procedural training. Subsequently, Wayne *et al.* further emphasised the management of deteriorating patients in a team setting was more effective than when individual nurses were working alone⁽⁵⁷⁾. Moreover, Nishisaki *et al.* in 2011 found from multidisciplinary simulation training that team behaviour ensured quality performance of tracheal intubation procedures in a paediatric ICU⁽⁸⁵⁾. Therefore, using simulation skills enabled the team to improve confidence more than when an individual nurse administers treatments to a sedated patient receiving EOLC.

The link between human patient simulation impacts on the improvement of nursing confidence and patient outcomes was clear in another study by Wolf in 2008 than shown by Wayne *et al.* The study could have used a more comprehensive methodological framework, rather than relying on entry charts. However, the findings affirmed that the incorporation of human patient simulation improved critical thinking and decision-making within a rural setting, which Cooper *et al.* associated with low knowledge and skill acquisitions among nurses. The study made a case for end-of-life decision-making, whose outcomes depend on how nurses gather skills over time^(86, 87). Nurses make informed end-of-life decisions in consultations with family and physicians when they understand the situation of the patients. Wolf in 2008 determined that interactions with human patient simulation for deteriorating conditions shaped confidence, which further influenced the development of the right patient outcomes⁽⁴⁸⁾.

Diverse themes emerged from the critical analysis of the 12 studies. Even though the studies used different approaches to evaluate HFS on the management of deteriorating patients' conditions, they affirmed its overall efficacy in improving confidence and patient outcomes, which underlined the clinical performance perspectives, which is cited in different journal articles^(49, 54, 57). The analysis further showed that optimal demonstrations of confidence occur within a team environment, as the sensitivity of patient issues reduces conflict. Additionally, studies show that simulation builds confidence that anchors informed decision-making, which is a critical element for patients sedated during EOLC. In addition, the transference of simulation skills was an important element of the studies, as the literature acknowledged the way self-learning and team sessions influence the way nurses use their acquired skills to manage patients in ICUs.

III. Discussion

Efficacy of Simulation in Critical Care

The majority of studies agree that simulation is an effective way of equipping registered nurses with the right skills that contribute to the overall management of critical care patients. According to Wayne *et al.*, teaching hospitals that deal with cardiac arrests cannot rely on the traditional methods of procedural training alone⁽⁵⁷⁾. Simulation-based training is an effective channel to foster patient care improvements; despite Buckley *et al.* acknowledging the challenges associated with the ever-changing conditions of critical care environments⁽²¹⁾. Buckley *et al.* insisted that the effectiveness of HFS among registered nurses depends on their

ability to recognise and respond to clinical emergencies. According to Van Schaik *et al.* in 2011, simulation training facilitates self-efficacy that promotes patient safety and outcomes of care institutions⁽⁸⁸⁾.

The implementation of HFS skills within the care settings is more relevant than the mere utilisation of skills to define patient outcomes⁽²¹⁾. According to Akhu-Zaheya *et al.*, HFS has proven more effective than the traditional teaching methods, which depend more on the application of theory, rather than the execution of hands-on skills within real care settings⁽⁸⁹⁾. However, the utilisation, retention, and execution of the knowledge in real care settings depend on self-efficacy, as well as nurses' perceptions⁽⁹⁰⁾. Furthermore, Kameget *al.* addressed the essence of communication skills when using simulation-based foster patient outcomes in real care settings. Overall, Buckley *et al.* insisted that the assertiveness of the skills acquired should expedite the optimal management of patient emergencies in critical care settings.

Wayne *et al.* determined that the efficacy of HFS in ICUs overcomes the challenges of the traditional methods of teaching nurses⁽⁵⁷⁾. Moreover, even though the effectiveness of the simulation methods depends on the patients' age, telemetry status, and ventilator, it should lead to quality care. Burns *et al.* viewed HFS as a problem-solving skill for students rather than registered nurses, although it has the capability to foster fuller knowledge retention, as well as attitude changes in the nursing process within real care settings⁽⁹¹⁾. Shinet *al.* agreed with Wayne *et al.* on the post-intervention improvements of nurses' performances following consistent conditions of HFS education, as opposed to the traditional learning methods^(57, 92). Hence, the studies imply the need to shift to advanced techniques of HFS to promote a higher level of efficacy in the nursing process, in order to deal with the ever-changing needs of critical care patients.

The efficacy of HFS in critical care settings manifests itself better in team settings, rather than individualised nursing environments⁽⁵⁴⁾. The findings by Meriénet *al.* in 2010 from another systematic review of HFS in acute obstetric emergencies determined the importance of multidisciplinary teamwork training for nurses to be effective in improving patient safety⁽⁹³⁾. However, Leonard *et al.* argued that complex clinical practice settings necessitate the correct perception of nurses within intra-professional teams⁽⁹⁴⁾. Hence, the studies confirmed the efficacy of HFS through team efforts is critical. Supporting intra-professional HFS education would foster multidisciplinary execution of simulation in real care settings.

Communication skills should foster the overall effectiveness of HFS applied within teamwork settings. According to Falcone *et al.*, established teams anchor the implementation of HFS skills on communication⁽⁵¹⁾. The reinforcement and evaluation of how education can define patient management depends on increased participation and sharing of ideas. Maxson *et al.* in 2011 argued that the effects of interdisciplinary simulation are founded on communication alone⁽⁹⁵⁾, as Falcone *et al.* implied, although on the perceptions of collaboration, together with perceptions in the nursing decision-making process. Ultimately, the communication in interprofessional teamwork is dependent on the attitudes and behaviours of nurses⁽⁹⁶⁾. Therefore, care institutions and respective departments, such as ICUs cannot disregard the role of team behaviours.

HFS as an antecedent for confidence of registered nurses in EOLC

HFS emerges as a critical influential factor on the confidence of nurses, which can occur in individual or teamwork environments⁽⁵⁶⁾. The study finds that the improvement of teamwork, confidence and the collaboration of nursing units in ICUs should improve the overall outcome of patients. The study reflects an understanding of EOLC, which might not be through simulation-based training alone⁽⁵⁶⁾. According to Adams *et al.*, nursing roles and strategies in acute care environments necessitate correct decision-making, which depends on the skills that nurses have acquired over time⁽⁷⁹⁾. Ranseet *al.* agreed with Adams *et al.* that the beliefs and practices of nurses should eliminate ambiguity and uncertainties that surround sedated patients receiving EOLC^(79, 97).

The confidence of the nurses' in managing acute care issues, such as AMI or COPD, among other terminal diseases, is dependent on the knowledge, skills, situational awareness, and ultimate performance of nurses. Cooper *et al.* emphasized the need to instill nurses with knowledge and skills of using HFS in order to generate high performance in deteriorating patients⁽⁵⁰⁾. The findings align with the arguments presented by Karlsson *et al.*, who viewed knowledge and ultimate confidence as the antecedents for the ethical management of the EOLC patients, but within home settings⁽⁹⁸⁾. Cooper *et al.* argues from the perspective of in-patient care settings but agrees that the ultimate performance of nurses should reflect the confidence fostered through simulation education⁽⁵⁰⁾.

Confidence and knowledge are interlinked elements in the management of patients sedated during EOLC, as per the arguments by different studies^(50, 98). However, Crumpe *et al.* considered nurses' perceptions of obstacles and support systems to be critical⁽⁹⁹⁾. HFS stands out as a source of support and positive perception required by critical care nurses to advance correct directives and a culture of care. Correspondingly, Billings *et al.* reasoned that the use of knowledge and the right perceptions depend on the insights conveyed through clinical experiences, which foster a confident-based clinical process⁽¹⁰⁰⁾. Even though the argument was based on

nursing student experiences, as opposed to registered nurses, it affirms that designing interventions, such as HFS, can help to create an outstanding culture and behaviour towards EOLC.

Barsuk *et al.* associated that the determination of the confidence gained through simulation depends on how well registered nurses can reduce procedure-related complications in medical ICUs(49). Furthermore, the study demonstrated an understanding of complex acute care, however, clinical competence and implementation of skills might vary with the nature of patients' complications(101). According to Moir *et al.*, complications can be reduced through knowledge and skills utilisation between caregivers and nurses(101). What is more, HFS provides the educational needs required to deal with the challenges that arise during EOLC. Quest *et al.* further reasoned that complications arise in the integration and initiation of knowledge learned(102). Subsequently, competence and confidence learnt through simulation help to complete the process with high quality and limited complications to the sedated patients.

The sustainability of knowledge, skills, and the ultimate confidence demonstrated by nurses in acute care environments requires repetition, as well as in-situ simulation. Dowson *et al.* realised that the use of simulation technologies improved qualified nurses' confidence when many of the participants underwent regular simulation training⁽⁵⁸⁾. The research affirms the influential role of the educational tool that enables nurses to familiarize themselves with the diverse challenges during EOLC. Besides, a study done in 2010 discovered that the challenges could be personal, environmental, and relational, although they affect the overall quality of care delivered to patients⁽¹⁰³⁾. Meanwhile, Gjerberget *et al.* opined that the most elementary challenge is the ethical decision-making. Consequently, the repeated simulation process enables critical care nurses to understand the diverse ways of using their knowledge and confidence gathered over time to deliver quality care⁽¹⁰⁴⁾.

Confidence and performance on decision-making towards EOLC

The confidence and performance of nurses gained through HFS structure the preferences of nurses during patient EOLC. According to Sharp *et al.*, simulation fosters self-confidence in nurses⁽⁵⁴⁾. Comparatively, Davison's study does not address the influence of simulation as a factor; he asserts the essence of self-reported knowledge and confidence gained through diverse education tools⁽¹⁰⁵⁾. Consequently, the decisions shape the trajectory of the illnesses or overall patient outcomes, as per the findings by Frost *et al.*⁽¹⁰⁶⁾. Accordingly, the sensitivity of diverse expectations and preferences requires critical awareness among clinicians, as well as established educational routine.

Confidence and performance outcomes for EOLC cannot be limited to the nurses alone. Wolf asserted that simulated scenarios should transcend patient issues that require critical decision-making⁽⁴⁸⁾. Hence, simulated scenarios articulate thought processes, which seek quality of care and the correct management of varied patients' expectations. The sensitivity of the patient issues may necessitate registered nurses to have the skills of handling the input of the family and other health care staff, particularly in a multidisciplinary environment⁽¹⁰⁷⁾. The input of registered nurses is geared towards meeting the expectations of the patients, although confidence or performance-oriented skills gained through simulation cannot assist informed decision-making without considering other aspects.

Confidence and performance determine the ultimate quality of life support of sedated patients during EOLC according to Hunt *et al.*, the exposure of registered nurses to Rapid Cycle Deliberate Practice - First Five Minutes (RCDP-FFM) simulated environments fosters a dependable residency that maintains the quality of patients⁽⁵²⁾. The findings align with the views of Del Río *et al.*, who insisted on the correct utilization of skills to meet the requirements of patients at the final stage of life⁽¹⁰⁷⁾. Therefore, gaining confidence is essential, although it should be geared towards prolonging the lives of patients in acute care settings. Bollig *et al.* argued that elements of confidence and performance should foster overall care plans to secure the lives of the patients⁽¹⁰⁸⁾. Hence, the quality of life of patients is a product of the advances in care planning after nurses have received sufficient skills through varied HFS scenarios.

The studies further emphasise the essence of simulated scenarios in creating self-confidence and performance of nurses in decision-making towards EOLC. However, Bullock⁽¹⁰⁹⁾ discovered that culture is an integral component of the decision-making model. HFS addresses the professional perspective of nurses. According to Bullock, cultural issues, such as beliefs, values, communication, and overall competency patterns influence the conduct of registered nurses towards managing EOLC. However, physician factors, such as knowledge, comfort, and feedback influence decision-making towards patients sedated during EOLC⁽⁵⁵⁾. Keating *et al.* added that confidence fosters other factors, such as the timing of discussions of critically ill patients⁽¹¹⁰⁾. Conversely, the longstanding effect of HFS on the confidence of simulation depends on the transference of the knowledge and skills.

Transference and sustenance of HFS knowledge and skills

The ever-changing expectations and requirement of sedated patients requires longstanding confidence, which implied the correct transference of simulation education. Wayne *et al.* observed that simulation-based educational training improves the quality of care among residents⁽⁵⁷⁾. Hence, the power of HFS emanates from

its ability to influence the competency of the registered nurses, but they should be willing to transfer the skills. In particular, according to Norman *et al.*, considerable gains are made using simulation in the actual environments⁽¹¹¹⁾. However, Brydges *et al.* argued that the optimal utilisation of the educational benefits of HFS depend on the progressive nature of the specific environments⁽¹¹²⁾.

The sustenance of the simulation skills emerged as an important component of HFS efficacy in improving nurses' confidence towards EOLC management. Confidence is a factor that develops over time when practitioners deal with diverse scenarios in real care settings⁽¹¹³⁾. According to Stevenson *et al.*, dissatisfactions could develop with the systems or situations within which they are expected to handle the patients⁽¹¹³⁾. However, nurses who have sustained the simulation-based skills over time develop the skills required to deal with diverse patient issues in acute care settings⁽¹¹⁴⁾. Furthermore, EOLC necessitates practitioners who can use their skills to prolong life and deal with the expectations of other parties, as per the argument by Brush *et al.*⁽¹¹⁵⁾. Consequently, the supremacy of simulation technology in defining the behaviours and attitudes of nurses in acute care settings depends on how well they can sustain the knowledge and subsequent self-confidence towards varied end-of-life demands.

Individual nurses have a role to play in the transference and retention of the skills learnt through simulation-based education. Dowson *et al.* realised the essence of personal decisions in simulations of paediatric emergencies and how they influenced nurses' outcomes. As a result, insight is necessary when preparing for real-life care⁽⁵⁸⁾. According to Birkhoff's study, individual issues, such as the cognitive, psychomotor, and effective skill acquisitions influence nurses' management without harming patients receiving acute-related care⁽¹¹⁶⁾. Consequently, nurses determine how they can replicate clinical practices in real care settings as per the findings from a systematic review study in 2009⁽¹¹⁷⁾.

Individual issues may not define the sustainability of the simulation skills and the confidence of nurses when they are not implemented in a multidisciplinary environment. According to Falcone *et al.*, high-fidelity trauma simulation enhances management emergencies and translates into limited errors⁽⁵¹⁾. Additionally, Figueroa *et al.* factored teamwork as part of the simulation training, which improved confidence and increased collaboration⁽⁵⁶⁾. Hence, registered nurses can use the skills to manage sedated patients solely during EOLC, although they can collaborate with other practitioners in ICUs to achieve self-confidence, as well as prolong the survival of patients. Moreover, Stocker *et al.* discovered that team training should be embedded in order for it to achieve the performance and disseminate the skills required among acute care nurses⁽⁵³⁾. Meanwhile, it is viewed that teamwork is the most important critical care code and it must be observed that this review had limitations.

Reflection on the Limitations of the Systematized Review

The relevant publications necessary for the systematised reviews were scarce. More availability could have informed a more in-depth analysis of the existing findings on the efficacy of HFS in improving the confidence of registered nurses in managing patients sedated during EOLC. Nonetheless, the studies provided a comprehensive analysis of the elementary issues defining the efficacy of simulation and its influence on the confidence of nurses in critical care environments. Overall, the review was not as rigorous as expected.

The studies used in the systematised review may have inherited the unseen bias of peer reviewers and journal editors. The findings presented herein could have inherited the exaggeration and negative results of parties involved in the publication process. However, the systematised review was as objective as possible. Additionally, undertaking a systematised review was a resource-intensive process.

The time-consuming screening and synthesis of the studies in the peer-reviewed journals limited the time required for the critique and discussion. Another practical challenge of implementing the search process was the selection objective through the inclusion and exclusion criteria. The review faced inevitable subjectivity in the screening process, due to the high number the literature available that did not address the problem under investigation. Similarly, the study had limited time to undertake a piloted screening process.

The studies lacked a consistent technique to implement the research design. The non-uniformity of the execution of the quantitative and mixed methodologies design led to the confusion of determining the accurate selection of studies. Even though the execution of the methodologies was not a fundamental criterion in the search strategy, they conflicted with the high level of detail and method expected in a systematised review. Additionally, the study did not utilise qualitative studies and RCTs, which are the ultimate standards for developmental research. However, the content of the articles contained the essential data and concepts required to answer the primary research question.

IV. Conclusion

The current research has aimed to determine whether HFS improves ICU qualified nurses' confidence in managing adult sedated patients during EOLC. The systematised review ascertained a direct correlation from HFS as an antecedent for high levels of confidence among registered nurses dealing with diverse cases during EOLC. The review showed that nurses require simulated scenarios to manage the challenges and ever-changing needs of patients who require EOLC. The study further focused on the achievement of other specific objectives.

One of the aims prompted an inquiry into the scope of HFS practice in improving the confidence of qualified nurses for adult patients sedated during EOLC. The review found that HFS facilitates the acquisition of knowledge, skills, and overall self-confidence required to deal with an adult, as well as paediatric cases of EOLC. The findings further viewed confidence as occurring at an individual level and through team sessions. Hence, the systematised review found that a complete education tool for qualified nurses requires insights into how to handle patient treatments, perceptions, and the input of respective family, as well as other health professionals. However, the sustainability of confidence depends on the nurses' ability to transfer and implement simulation knowledge, accommodate physicians and patient factors, such as ethics.

Another objective of the systematised review was to determine the effectiveness of HFS manikins on the competence of qualified nurses in managing sedated patients during EOLC. All the studies confirmed that the effectiveness of HFS as a constructive tool for the competency of residents and other practitioners dealing with the diverse expectations of EOLC. Overall, the utilisation and execution of the skills depended on the length of the simulation training; nurses became more competent with regular and repeated HFS sessions, as well as when the familiarization occurred in multidisciplinary settings.

The research sought to present an understanding of the clinical benefits of nurses increased knowledge, skills, and competencies that result from HFS manikins in real life situations. The review revealed that nurses gained critical decision-making proficiency due to exposure to HFS scenarios. Education enabled them to consider the input of other parties, including families and consultants, who have material insights regarding how to deal with patients receiving end-of-life care. Furthermore, the studies showed that qualified nurses achieve better clinical performances in multidisciplinary and team settings. Additionally, the administration of HFS sessions in the team and multidisciplinary settings eliminated the isolation, flawed attitude, and behaviour to foster self-confidence, as well as overall work satisfaction. Consequently, the qualified nurses managed to reduce the risks and complications involved with EOLC.

Nursing education institutions and health care organisations should consider regular and repeated HFS training for qualified nurses. This education tool is essential for all nurses in diverse departments, and not merely in ICUs. The self-confidence of nurses is a quality indicator of how well nursing practices can depart from the limited scope of traditional methods of procedural training. The review further demonstrates that nurses' self-confidence should enable institutions to develop skills against a backdrop of favourable work environments. Ultimately, nurses can use the integrated and collaborated structures to meet the expectations of the patients, families, and external parties in relation to EOLC.

In addition, fostering a teamwork policy should be treated as an antecedent for the sustainable confidence of qualified nurses charged with dealing with patients sedated during EOLC. Simulation-based teamwork has emerged as a component for knowledge, skills, competence, and ultimate favourable behaviours. Similarly, correct behaviours could enable departments, such as error reduction and complications presented by the patients who are received EOLC. Furthermore, inter- and intra- disciplinary engagements are critical for qualified nurses to exchange ideas on how to exploit the innovative technology of HFS to improve patient outcomes.

Other elementary issues in EOLC, such as team coordination, communication, leadership, positive perceptions, and attitude towards the safety of patients in ICUs are part of policymaking. Accordingly, nursing practices cannot be limited to the performance of the qualified nurses. Learning institutions should remind learners that their professionalism depends on how well they customise their skills to meet patient outcomes. Finding personal ways to deal with patient challenges requires familiarization with scenarios that stem from team coordination, communication, leadership, positive perceptions, and attitudes.

Implications for Future Research

The current systematised review focused on literature with quantitative and mixed methodologies. However, evaluating authors' perspectives from different research designs impeded optimum interpretation, as well as critical analysis. Subsequently, future research can avoid this resource-intensive and time-consuming process by utilising the gold standard of RCTs, instead of a systematised review. RCTs should be able to generate similar or more progressive outcomes regarding the efficacy of HFS in improving the confidence of ICU qualified nurses in dealing with EOLC patients.

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