

High Fidelity Simulation in Nursing Education

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ABSTRACT

Aim: This paper reviews the use of high fidelity simulation (HFS) in nursing education.

Methods: An integrative review was used to assess the effectiveness of high fidelity simulation in nursing education. Data search was between 2007 to 2016 using CINAHL, Cochrane, EMBASE, ERIC, MEDLINE, Ovid, Proquest, PsycINFO, Scopus, SciVal, Web of Science, Joanna Briggs Institute and EBSCO host. A total 45 articles met the eligibility criteria.

Discussion: Themes materialised were: learning in a safe, supportive and simulated environment, self-satisfaction and confidence, critical thinking and clinical reasoning, clinical decision-making and clinical judgement, knowledge retention and gain, skill acquisition and performance, interprofessional collaborative practice and nursing care, teamwork and communication, development of cognitive, psychomotor and behavioural skills.

Conclusion: HFS provides diverse learning experiences, promotes decision-making and skill acquisition to develop assessment and safe practice.

Implication: Nurse educators can create a variety of patient conditions for collaborative nursing care for increasing learning outcomes.

Key words: high fidelity simulation, technology, learning outcomes, students, nursing education

Highlights

HFS contributes to diverse learning experiences, knowledge retention and skill acquisition in a safe and supportive environment.

HFS improves the quality of learning, organization of care, team work and promotion of clinical decision-making.

HFS nurtures and develops cognitive, psychomotor and behavioural skills for interprofessional collaborative practice.

INTRODUCTION

Nursing practice is intellectually and emotionally challenging because it requires quick judgments and responses to life-threatening conditions. Nursing students experience 'reality shock' while learning in the clinical environments. Advanced technology like e-learning is used for improving active learning, participation and communication with students (D'Souza et al., 2014). It helps student engagement in

active learning, faculty-student interaction and diverse experiences (D'Souza et al., 2013). Simulation is defined as a pedagogy used to promote a student's progression from novice to expert (Meakim et al., 2013, p.9).

High-fidelity human patient simulation (HFS) is the distinct use of computerised manikins, virtual simulation or standardized patients in life-like safe realistic nursing simulated scenarios (Hinchcliffe-Duphily, 2014; Phillips, 2011).

HFS bridges the use of technology for learning experiences and guided reflection in a safe realistic nursing environment. HFS may improve students' thinking, emotional, decision-making abilities (Wotton, Davis, Button & Kelton, 2010), knowledge and understanding (Gates, Parr & Hughen, 2012; Partin, Payne & Slemmons, 2011; Weaver, 2011). HFS provides an interactive, participating learning environment (Powell-Laney, Keen, & Hall, 2012; Sideras et al., 2013) and reinforce knowledge, clinical skill acquisition (DeBourgh & Prion, 2011). HFS increases clinical judgement (Cato, 2012; Hayden, Smiley, Alexander, Kardong-Edgren & Jeffries, 2014; Thomas, McIntosh & Allen, 2014) and builds self-confidence (Aerborsol & Tschannen, 2013; Jeffries & Rogers, 2012; Oldenburg, Brandt, Maney & Selig, 2012).

HFS is skilled to replicate physiological response and is useful for effective learning (Lewis et al., 2012; Shearer, 2013) and performance (Powell-Laney et al., 2012; Bogossian et al., 2014) in complex patient scenarios (Garrett et al., 2011). HFS focus on the specific contextual and conceptual areas to advance problem-solving and critical thinking skills among novice students to become expert nurses (Institute of Medicine, 2010). HFS develops skill competencies (Whyte et al., 2012) and contributes to cognitive and psychomotor outcomes (Liaw, Scherpbier, Rethans, & Klainin-Yobas, 2012). It improves patient safety (Brady, 2011; Handwerker, 2012) by improving critical thinking, validate information, clinical judgement. Student's engagement in meaningful processes, participation and focused attention improves clinical reasoning, learning for understanding and conceptualizing (D'Souza, Isac, et al., 2014). Hence novice nurses have an advantage point through observation, identification and prioritization of concepts or care for improved learning outcomes.

Aim

This paper aims to identify the best evidence on the effectiveness of using high

fidelity simulation technology for learning outcomes in nursing education.

METHOD

An integrative review was used to assess the best evidence on the effectiveness of high fidelity simulation technology and learning outcomes in nursing education.

Inclusion criteria

Type of participants

The review includes HFS used in the undergraduate nursing students. Studies including other health care professionals were excluded.

Type of intervention

The intervention is the use of high fidelity patient simulation technology in nursing education.

Type of outcome

The primary outcome are learning outcomes like satisfaction, confidence, cognitive, conative and affective in nursing education as assessed by validated and reliable quantitative data collection methods.

Type of studies

The experimental designs using randomised controlled trials, quasi-experimental and analytical studies were considered and summaries were used to identify the best evidence.

Search strategy

The search strategy assessed published studies written in English language after 2007. Initial search was done to reveal all relevant concepts relating to the aim of the review. Initial search included PubMed, Cumulative index to nursing and allied health literature (CINAHL) and MEDLINE shadowed by an analysis of the text words contained in the title, abstract and index terms. Keywords were nursing education, nurse, simulation, human patient simulation, manikin, technology, outcomes, teaching, learning, efficacy and high fidelity. This search recorded 472, 381 and 294 articles respectively, while duplications existed. The focus was advanced to HFS and learning outcomes in nursing, simulation and teaching, simulation and education and HFS and effectiveness. A second search of the

electronic databases was used with some combinations and permutations of key words and index terms recognised by the initial literature scoping. Defined search and retrieval methods were used in searching databases like PubMed, CINAHL, Cochrane, EMBASE, ERIC, MEDLINE, Ovid, Proquest, PsycINFO, Scopus, SciVal, Web of Science, Joanna Briggs Institute and EBSCO host. A total 368 articles were identified after excluding the duplication from the nursing literature.

A total of 45 articles had common consensus between the two reviewers with the aim of the review. Among the 45 articles, 18 articles were experimental, 15 were quasi-experimental, and 12 were analytical studies. The findings of each study were considered with codes for identification from the literature, summarization, synthesis and inferences, and discussion of findings for clarifying the interpretation themes.

Methods of the review

Assessment of methodological quality

Articles selected for retrieval were assessed for methodological validity by two independent reviewers prior to inclusion in the review. Critical appraisal assessment and review was done with agreement between the reviewers and a third reviewer was consulted when needed.

Data collection

Data was extracted from the literature included in the review using standardised data extraction using specific details about the interventions, populations, study methods and outcomes of significance to the aim of the review.

RESULTS OF ANALYSIS

Review articles show that simulation and debriefing is an interactive forum to transform knowledge to practice for safe and effective patient care in a non-risk learning and environment and impacts the quality of learning (Bradley, 2011). It is effective for improving performance and organization in intensive care (Nimmo,

Shippey & Fluit, 2008). Engagement in simulation increases learning experience and replaces time spent with patients in the clinical placement (Berragan, 2011). Registered nurses also play a vital role for final year students to facilitate teaching-learning (D'Souza, Jolly & 2013). HFS was useful in increasing clinical reasoning skills among nursing students (Lapkin, Fernandez, Levett-Jones & Bellchambers, 2010). Nursing student (n=151) responses had positive perceptions of simulation as useful to realizing learning objectives (Howard, Englert Kameg, & Perozzi, 2011).

Literature shows that simulation improves communication, accountability, awareness of nursing action, performing to the best ability, practice and repetition of skills, errors and omissions. It improves critical thinking, clinical judgment, skill acquisition, clinical reasoning, patient safety and interprofessionalism (Bussard, 2015). Nursing students (n=147) had significant core competencies and professional attitude in active learning compared to traditional learning group (Shin, Sok, Hyun & Kim, 2015). Nursing students (N=5) showed that simulation experience provides skill acquisition in a safe, controlled environment and is an integral part of nursing education (Henneman & Cunningham, 2005).

Use of remote communication devices, information sharing, skills and coping in emergencies showed significant differences in the haemorrhage and respiratory simulated scenarios. This helps to trigger cognitive processes for efficient orientation and awareness in situ-interventions (Chapelain, Morineau & Gautier, 2015). Advanced novice to competent intensive care registered nurses (n=53) showed significantly higher scores in assessments and team performance in the simulated emergency and cardiac arrest scenarios in different specialties in Ottawa (Ballangrud, Persenius, Hedelin & Hall-Lord, 2014). Adult health nursing students (n=143) reported high satisfaction and acute care knowledge and skills in simulated acute units and supportive learning environments

(Nickless, 2011). Nursing students (N=16) expressed satisfaction with simulation experiences (Lewis & Ravert, 2014).

Students had increased identification of safety measures in alcohol withdrawal scenario, assessments, identifying and prioritizing nursing interventions in simulated critical mental health scenarios of psychosocial concepts and debriefing reflection and inquiry. This promotes communication exchanges between student and simulated patient (Beckford, 2013). Mental health simulation scenarios improve theory to practice skills and experience through simulated real life and they are valued in learning among Australian nurses (Edward, Hercelinskyj, Warelw & Munro, 2007). Psychiatric mental health nursing students (n=20) believed that simulation activity was effective to practice assessment, critical thinking, decision-making, and nursing care in augmenting real-life clinical experiences. Consequently simulation scenarios were experiential, constructivist and reflective learning in increasing learning (Murray, 2014).

Nursing students (n=35) found a significant increase in team-based behaviours, cultural, practice, shared mental model, adaptive communication and response, cooperation with simulation (Garbee, Paige, Bonanno, Rusnak, Barrier, Kozmenko, & Nelson, 2013). There is a challenge of impact of learning outcomes on translation of skills to clinical management of various patients or interaction with various disciplines. BScN Chinese students (n=59) had high satisfaction and self-confidence, objectives and information with moderate-fidelity MicroSim compared to HFS SimMan (Wang, Fitzpatrick & Petrini, 2013). BSN medical surgical nursing students (n=94) had significant mean exam scores in simulation compared to didactic. HFS is innovative in gaining and knowledge retention (Strickland & March, 2015). Second year undergraduate nursing students (n=104) reported high knowledge and satisfaction with current learning, self-confidence in learning with independent

roles to develop practice, communication and collaboration skills in HFS (Thidemann & Soderhamn, 2013).

Nursing students (n=260) expressed higher knowledge and skill competence scores compared to the control group (Hana, Mohamed, Amany, Sheble & Shrief, 2014). Students (n=16) had improved knowledge, performances and self-confidence in simulation compared to other methods (Liaw, Scherpbier, Rethans & Klainin-Yobas, 2012). First year pre-licensure nursing students (n=168) had higher perceived competence (Oldenberg, Maney, & Plonczynski, 2013). American and Norwegian students (n=48) perceived increased practice, confidence and cultural awareness with simulated patients (Grossman, Mager, Opheim & Torbjornsen, 2012). American students (n=144) had significantly higher performance retention and self-confidence in simulated scenarios compared to other active learning strategies (Swanson, Nicholson, Boese, Cram, Stineman & Tew, 2011). Junior American nursing students (n=134) have had improved assessment skills, critical thinking and satisfaction to learn different nursing roles in the simulated scenarios (Guhde, 2011). Midwest American students (n=120) had higher therapeutic performance skills in paediatric simulation experiences compared to control group (Meyer, Connors, Hou, & Gajewski, 2011).

Senior nursing students (n=61) had significant differences in simulation compared to traditional learning (Rode, Callihan & Barnes, 2016). Nursing students (n=35) identified planning and prioritizing, understanding and implementing knowledge and communication and thoughtfulness, self-awareness (Lestander, Lehto & Engstrom, 2016). Students (n=60) reported better improvements in clinical judgement and performance in real acute situations using HFS compared to traditional learning (Hallin, Backstrom, Haggstrom & Kristiansen, 2016). Nursing students (n=72) had significant improvement in self-confidence, critical thinking skills and

problem solving tasks and objectives in simulation scenarios (Ahn & Kim, 2015). Nursing students (n=107) perceived HFS as promoting critical thinking, confidence, competence, theory-practice integration and knowledge identification (Kaddoura, Vandyke, Smallwood & Gonzalez, 2016). Nursing students (n=42) have higher mean clinical judgement scores and improved over time in the intervention group compared to the control group. They expressed structured debriefing as learner focused and holistic (Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013).

Interdisciplinary health care communication performance, SBAR, physician reporting blood pressure and oxygen saturation and client identification were higher among senior nursing cohorts exposed to repeated simulation learning. It helps to organize information, care, complete reporting and decision-making (Krautscheid, 2008). Inter-professional collaboration simulation scenarios benefit students to think critically, and apply theoretical knowledge to manage emergencies and varied patient conditions to ensure safe patient care (Ying et al., 2011). Nursing students (n=15) had positive feedback about participation in interprofessional teamwork and cohesive team in delivering care to the dying patient and their families in a simulated palliative care environment. They felt the need for patient and family-centred care and focus on patient and family needs (Gillan, Arora, Sanderson & Turner, 2013). Nursing students (N=41) had significant improvements in knowledge retention and translation to patient care with simulation compared to didactic lectures and MCQs in critical care (Solymos, O'Kelly & Walshe, 2015).

Pre-briefing on expectation in the simulation environment and debriefing model as a guided reflection improves in complex interventions and simulated patient deterioration scenarios. It improved perceptions of deterioration and development of appropriate responses in

practice (Lavoie, Pepin & Cossettee, 2015). These studies show that HFS is an effective teaching-learning tool to improve clinical competence, critical thinking, self-confidence, and integration of knowledge in safe, controlled environment. It reinforces knowledge in a safe patient care environment and enhances newly learned skills.

DISCUSSION

In this integrative review, common themes emerged were learning in a safe, supportive and simulated environment, self-satisfaction and confidence, critical thinking and clinical reasoning, clinical decision-making and clinical judgement, knowledge retention and knowledge gain, skill acquisition and performance, interprofessional collaborative nursing and nursing care, teamwork and communication, development of cognitive, psychomotor and behavioural skills in nursing.

Review studies revealed that BScN students and Registered nurses, at various levels, ages and disciplines had higher satisfaction, self-confidence to face real clinical situations in a safe controlled environment. Higher satisfaction and self-confidence were observed in anticipating scenarios related to assessment, readiness to intervene appropriately and interpreting the situation comprehensively. Satisfaction and self-confidence are internal outcomes of simulation experience (Norman, Dore, & Grierson, 2012) and have presented improvements in critical cue recognition and problem identification (Rodriguez, 2015). Moderate-fidelity simulation received significantly higher scores in students' satisfaction and self-confidence, while the high-fidelity simulation showed better implementation of the simulation design (Wang et al., 2013). Higher age, higher GPA, completion of clinical courses and senior cohorts was associated with the Student engagement mean scores (D'Souza, Isac, et al., 2014).

Pre-briefing, simulation and debriefing was beneficial in sequencing of

the learning experiences, especially in the “feedback/guided reflection” improves critical thinking, persistence of reflective thinking for patient care (Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013) and active learning (Sinclair & Ferguson, 2009). This encourages engagement in learning major concepts and collaborative practice (Titzer, Swenty, & Hoehn, 2012) and ‘learning as a concept’ (Tosterud, Hedelin, & Hall-Lord, 2013). Structured objectives, feedback and high expectations during simulation experiences prompt student nurses to expand their competency levels. Feedback on performance and satisfaction was effectively used in the premises of learning for preparing nursing students (D’Souza et al., 2015). These studies spectacle that simulation learning experiences increases student’s hands-on experience and links theory and nursing practice through hands-on experience and guided reflection.

Students learn to make sound decision-making and critical thinking (Goodstone et al., 2013; Loke et al., 2014) and advanced skills (Mills et al., 2014). It improves clinical judgement (Bultas et al., 2014; Hao et al., 2014) and nurture affective and cognitive learning (Kaddoura, 2012; Kaddoura & Williams, 2012; Lowenstein, 2014). HFS is an effective tool to improve competence (Bultas et al., 2014; Lucas, 2014; Mould et al., 2011) learning in nursing (Tawalbeh & Tubaishat, 2014). Students have increased satisfaction (Sharp et al., 2014), knowledge retention (Tawalbeh & Tubaishat, 2014) and self-efficacy and self-confidence (Cardoza & Hood, 2012; Lucas, 2014). Age and GPA have significant satisfaction with the learning environment among Omani nursing students (D’Souza et al., 2015). Students manifested higher self-confidence, critical thinking and problem solving abilities in the simulation scenarios. This can develop their psychomotor competencies with simulated technology to manage nursing problems, emergencies and collaboration for safe patient care.

Students reported engagement in learning (Gates et al., 2012; Liaw et al., 2012; Yuan et al., 2012), ‘theory-practice integration’ and application of skills. It improves transfer of learning into nursing practice (Gates et al., 2012; Liaw et al., 2012; Yuan et al., 2012) with no-risks in the safe environment (Oermann & Gaberson, 2014). Active learning improves competency (Shin et al., 2014) engaged in learning opportunities. These quantitative evidences highlight that HPS is an effective teaching method for undergraduate nurse education (Strickland et al., 2015). Therefore, simulation provides visualization of unexpected emergencies in a safe environment to develop assessment and management practice. Hence, HPS supports students’ self-satisfaction, confidence, and knowledge retention and skill acquisition with debriefing. HPS provides real clinical experiences for teaching concepts and application of nursing using patient scenarios of varying acuity.

Literature search can be directed towards qualitative approach to gain a comprehensive insight into psychosocial and behavioural outcomes and translation into clinical practice.

CONCLUSION AND IMPLICATION

Nurse educators can create and develop a variety of patient conditions in various specialities to learn to manage nursing care and collaborated with health care. Use of HFS for improving learning outcome in nursing education is an effective and innovative tool. Satisfaction with and effectiveness of the learning environments are influenced by cognitive, psychomotor and affective skills, and problem-solving abilities. The use of high-fidelity clinical simulation into the undergraduate nursing education can improve the quality of learning, can help students for team work, problem-solving, organize care and promote clinical decision-making. This can improve knowledge, performance and attitude among nurses for application and translation to bedside practice. Debriefing and pre-

briefing provide interactive sessions to apply knowledge and exchange critical elements and key points in nursing care. Integration of HFS in nursing education can reinforce the standards of nursing practice and student learning outcomes for safe nursing practice. Simulation is useful in BSN and RN programs with specialised training in a safe environment at the rate and direction of the student for self-discovery, self-directed and independent learning.

Authorship

MSD, PA and RV provide substantial contributions to the conception, acquisition of review, drafting the article, revising it critically for important intellectual content and agreed on the final version of the paper to be published. Melba Sheila D'Souza (MSD), PorkodiArjunan (PA) and Ramesh Venkatesaperumal (RV).

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