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The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses

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This is to certify that I have examined this
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and have found that it is complete and satisfactory in all respects,
and that any and all revisions required by
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EXECUTIVE SUMMARY

Obstetric complications can be anticipated based on certain risk factors before they become emergent such as maternal post-partum hemorrhage. The challenge for smaller hospitals is that there is a low incidence rate of obstetrical emergencies for nurses to develop and maintain competency in providing care. A component to providing competent care is the possession of the non-clinical skill of Situational Awareness (SA). High-fidelity simulation technology has generated opportunities to create realistic simulations during which nurses can develop components that promote SA (confidence, knowledge, and critical thinking ability) without endangering real patients.

Patients deserve safe and quality care from practitioners regardless of prior training; therefore, there is a need to examine how simulation is an effective way to train all nurses for complex and rare patient situations. The purpose of this system change project was to review and analyze the literature as well as evaluate participant data related to the effect of high-fidelity simulation education on a nurse's situational awareness.

Ten novice obstetric nurses from Mayo Clinic Health System – Franciscan Healthcare participated in the simulation study at Viterbo University's Simulation Learning Center. SA was measured as a latent variable and evaluated on whether participants improved their knowledge levels, confidence levels, and showed evidence of clinical decision making following the simulation. The Confidence and Knowledge surveys were evaluated separately by a t-test to determine statistical significance. The Clinical Decision Making ability was assessed by the researcher based on whether the participants met pre-set benchmarks within the simulation.

The results from the study showed evidence that there were participants that increased their knowledge level, confidence level and demonstrated critical thinking but not all three

components together. Overall the data revealed a trend towards the participants increasing the components of SA and therefore a trend toward increasing their SA. Anecdotal comments from the participants were also collected.

Critical to increasing and maintaining the nursing workforce is the successful training of nurses in the work setting. Increasing specialized training and dedicating educational resources for nurses may help produce a staff with more competent nurses. This SCP does provide support for the use of high fidelity simulation education to develop SA for critical experiences in the acute care setting.

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Chapter I

High fidelity simulation is a technologically advanced method of educating nurses. The Institute of Medicine has recommended simulation as an effective method of teaching for complex and high risk situations experienced in clinical practice (Durham and Allen, 2008). As the use of simulation technology is integrated into nursing education and nursing practice, the need for exploring the effects of this technology is necessary. This author facilitated an educational project with a hospital unit and a university's simulation center to train novice nurses in a critical situation to heighten their situational awareness (SA). Analysis of current literature and a comparative study to assess whether patient simulation is an effective way to train nurses for complex patient care was conducted. A collaborative effort between Viterbo University's Simulation Learning Center and Mayo Clinic Health System – Franciscan Healthcare (MCHS-FH) hospital was established to explore simulation as a teaching methodology for registered nurses practicing in obstetrics.

Background

Patients that become critically ill in a hospital environment commonly exhibit an identifiable period of abnormal physiologic symptoms before deteriorating to a catastrophic event and it has been established that early intervention may cease their decline (Marshall et al., 2011). The Institute of Medicine (IOM) has recognized the need for excellent emergency peripartum care and has recommended the use of simulation training to reduce medical errors and improve patient safety (Merien, Van de Ven, Mol, Houterman, & Oei, 2010).

The high-fidelity mannequin technology has been called, “one of the most important resources in nursing education today” (Bremner, Aduddell, Bennett, & VanGeest, 2006, p. 170). According to Decker et al. (2011) and Allen et al. (2008) there are many benefits to utilizing high-fidelity simulators because they can be programmed to respond in a predictable manner. Simulators are designed and programmed to deliver a realistic and sophisticated level of interactivity and fidelity for the learner (Jeffries, 2007). The high-fidelity Guamard ‘Noelle’ is a full body female mannequin coupled with a computer program which simulates the anatomy and physiology of a pregnant woman and a variety of pathological states. The simulation computer program may be designed for evaluation of professional competencies at many experiential levels (Decker, Sportsman, Puetz, and Billings, 2008, p. 75). Simulation training provides the opportunity to identify and reflect on critically ill patient scenarios, choose appropriate interventions, and provide essential lifesaving skills in “real time” (Currer, 2008).

Reflection occurs primarily in debriefing. Debriefing is the process whereby educators and participants reexamine the simulation encounter (Dreifuerst, 2009). Debriefing helps to identify gaps in a learners’ knowledge that may otherwise go unnoticed (Kaddoura, 2010). “The debriefing activity reinforces the positive aspects of the experiences and encourages reflective learning” (Jefferies, 2005, p. 101). Participants recognize what they have done well and what needs improvement. Participants viewed debriefing and reflection as an essential component to developing their critical thinking ability (Kaddoura, 2010). Additionally, participants reported a decreased level of performance anxiety and an increased level of self-confidence in skills and critical thinking ability (Jeffries, 2007).

Nursing is a practice profession whereby active learning is the preferred method to achieve competence (Sportsman, et al., 2009). Developing, achieving, and maintaining clinical

competence is an individual and employer responsibility to ensure that nurses are providing safe and quality care (Sportsman, 2010). Nurses demonstrate increased competence based on years of experience; however, new nurses are required to provide equally competent care as their seasoned colleagues (Galloway, 2009). Training and evaluation must develop and assess nurses' ability to demonstrate clinical judgment (Decker et al., 2008 and Allen et al., 2008) which may be more than their knowledge and technical ability.

Non-clinical skills are challenging to define and may include task management, team-work, decision making, situational awareness (SA), and stress management (Flin & Maran, 2004). Endsley (1988) has defined SA as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future" (p. 97). Essentially, SA is the act of gathering and understanding information (background knowledge) and projecting and anticipating future events (clinical decision making) (Flin et al., 2007). "Uncertainty in a situation is likely to reduce a person's ability to make sound decisions" (Wright, Taekman, and Endsley, 2004). Therefore, increased confidence levels would help produce more sound decision making. Wright, Taekman, and Endsley (2004) expressed that background knowledge also may influence one's SA and that one needs SA to aid in their clinical decision making ability. Simulated training in obstetric emergencies has been studied as a means to improve proficiency and efficiency of the practitioner (Osman, 2009).

Obstetric complications can be anticipated based on certain risk factors before they become emergent such as maternal post-partum hemorrhage. The rarity of the life-threatening emergencies makes it difficult to train hospital professionals to identify and manage them safely (Osman, 2009). Therefore, education for the obstetric patient population was analyzed further as a part of this study.

Problem Statement

The purpose of this system change project (SCP) was to identify whether simulation education affects a novice nurse's situational awareness in an obstetrical emergency. Situational awareness was measured as a latent variable and evaluated according to the following measures: (1) improved knowledge score by at least one point after the novice nurse's simulation experience; (2) improved confidence score by at least one point after the simulation experience; (3) completion of the simulation scenario within the 20 minute programmed timeframe; and (4) correct answers on SA assessment questions after the simulation.

Summary

This SCP has been designed to implement and evaluate a process for simulation education for hospital nurses. Simulation will provide educators from the hospital setting with an advanced method of training their nurses. The following chapters offer a description of the theoretical framework, review of literature, and development and implementation of the SCP. A discussion of the results and recommendations will conclude the paper.

Chapter II

The following chapter will provide an overview of the theoretical frameworks that support the utilization of simulation in educating nurses to enhance their situational awareness. In addition, a comprehensive literature review of evidence to support using simulation as a teaching method promoting situational awareness is presented.

Theoretical Framework

Theories are valuable in the field of nursing; they help provide a framework and stimulate the hypothesis of outcomes for evidence based projects. There were three theories that guided this system change project. The Nursing Process Theory developed by Ida Jean Orlando, the Experiential Learning Theory developed by Dr. David Kolb, and the Theory of Situational Awareness that was developed by Dr. Mica Endsley. These three theories ground the need for the use of simulations in nursing education. Each theory also gives meaning to the essence of this project.

Nursing Process Theory

Orlando's theory focuses on how to improve a patient's behavior (Tomey & Alligood, 2006). The nurse's responsibility is providing whatever type of care the patient needs in order to have his or her needs met. "Evidence of relieving the patient's distress is determined by positive changes in the patient's observable behavior" (Tomey & Alligood, 2006, p. 436). Orlando emphasized that there is a positive relationship between the patient's length of time suffering and the degree of stress. Simulation allows the participant the opportunity to practice identifying patient needs and determining the correct intervention to improve the patient's outcome in a timely manner.

Experiential Learning Theory

According to Experiential Learning Theory, "Learning is a continuous process, and knowledge is created by transforming experience into existing cognitive frameworks, thus changing the way a person thinks and behaves" (Lisko and O'Dell, 2010, p.106). Kolb's (1984) theory supports a process of learning through experience. The learner then reflects on that experience, creates conceptualization, and then takes that new knowledge and applies it to future experiences (Waldner & Olson, 2007). Simulations can present students with a variety of learning situations and can help nurture the development of new knowledge and skills**.** For example, the nurse may use simulation training to experience a critical situation, reflect on the outcome and then be better prepared in the future to react appropriately.

Theory of Situational Awareness

Situational Awareness was originally developed from the field of aviation and has more recently been applied to medicine (Cooper et al., 2010). Situational awareness is the "perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in their near future" (Endsley, 1988, p. 98). An important detail to consider is that SA changes as the environment changes most likely due to the actions of the individual and outside influences (Wright, Taekman, & Endsley, 2004). A nurse assessing the patient's presenting symptoms through simulation and choosing to intervene based on his or her knowledge of how the patient may decline is an example of SA.

In addition to the aforementioned theories there is research evidence to support this system change project. Research studies, systematic reviews, and national guidelines were analyzed for evidence to support using simulation as a teaching method to improve one's SA.

Critical Analysis of the Evidence Related to the Clinical Question

A critical analysis of nine original research studies revealed support for the use of simulation as an educational method. The studies measured three common variables: confidence levels, knowledge levels, and/ or clinical decision making ability. These three variables support the situational awareness of a practitioner. The nine articles were analyzed further to ensure relevancy in the review and to identify themes (Appendix A). Additionally, systematic reviews and national guidelines were analyzed for support of the clinical question (Appendix B).

Search Method and Outcome

A systematic search was conducted for original research studies between 2005 and 2011 that compared the use of simulation with other methods of education in healthcare. The four databases used were: CINAHL, EBSCO Host, PubMed, and ProQuest. The primary search terms were "simulation" and "competency" with no initial discipline-specific focus. "Nursing" as a search term was too limiting. Each database was then searched using the broad terms of: "simulation," "education," "competency," "obstetrics," "drills," and "situational awareness." Of 350 references located, those reporting studies of simulation in obstetrics education were retained.

Variables of Situational Awareness

All nine studies reported statistical improvements in confidence levels, knowledge levels, and / or clinical decision making ability, indicating that simulation education was an effective teaching method.

Confidence

Confidence levels were measured in four studies and consistently measured with a Likert scale (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005;

Limoges, 2009). The researchers that evaluated confidence as one of their variables used t-tests or evaluated means and standard deviations to analyze their results (Bambini, Washburn, & Perkins, 2009; Vadnais et al., 2011). Birch et al. (2007) and Limoges (2009) produced qualitative results for a descriptive summary of their participant's experience. The participants showed an increase in confidence levels from simulation education across all five studies (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005; Vadnais et al., 2011; Limoges, 2009).

Knowledge

Knowledge levels were measured with a multiple choice questionnaire (MCQ) in four of the studies (Birch et al., 2007; Cooper et al., 2010; Crofts et al., 2007; Vadnais et al., 2011). The MCQs were inconsistent with the number of questions, the questionnaires ranged from 11 to 240 questions to assess the knowledge base of the subjects in their particular area of obstetric medicine. The researchers mentioned that the questionnaires were created by content experts. None of the studies discussed the reliability of the measures. It was difficult to place confidence in a study's findings if the instruments had weak validity or reliability.

The questionnaires were evaluated with t-tests in all studies (Birch et al., 2007; Vadnais et al., (2011) except Crofts et al. (2007) who used one-way ANOVA to obtain their results and Cooper et al., 2010, who only measured knowledge once throughout the study. The findings for the researchers that studied knowledge all showed an increase in scores (Birch et al., 2007; Cooper et al., 2010; Crofts et al., 2007; Vadnais et al., 2011). Crofts et al. (2007) and Vadnais et al. (2011) showed statistical significance for their findings.

Clinical decision making

Clinical decision making was measured in five studies using two independent raters to evaluate their subjects' performance all with a unique tool of which was created for the study and not officially validated (Birch et al. 2007; Cioffi, Purcal, & Arundell, 2005; Cooper et al., 2010; Daniels et al., 2010; Deering et al., 2009). Cooper et al. (2010); Cioffi, Purcal, & Arundell (2005) and Deering et al. (2009) provided inter-rater reliability scores of 72%, 89% and 92%. These results were concerning because inter-rater reliability scores should be above 90% and the evaluators should have had multiple opportunities to use the measurement tools and increase the score (Melnyk & Fineout-Overholt, 2005). There was a variance in how the researchers analyzed the results from the studies (Birch et al., 2007; Cooper et al., 2010; Daniels et al., 2010; Cioffi, Purcal, & Arundell, 2005; Deering et al., 2009). A t-test was used in three studies (Birch et al., 2007; Cooper et al., 2010; Daniels et al., 2010), means and standard deviations were used by Cioffi, Purcal, & Arundell (2005) and there was no statistical analysis done on the post-test only study conducted by Deering et al. (2009). A post-test was appropriate in their study because their research was to validate their study tool, evaluating the participant's clinical decision making was a secondary focus. The findings showed an increase in their participant's skills (Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005; Cooper et al., 2010; Daniels et al., 2010) and Copper et al. (2010) and Daniels et al. (2010) demonstrated statistical significance with their findings.

Overall Study Characteristics

The nine studies all measured a combination of one or all three of the above mentioned variables. There was only one study that directly measured situational awareness (Cooper et al., 2010) which was the focus of the author's clinical question. The researcher measured SA with a 17 item yes-no questionnaire during a "stop-time" called three minutes into the simulation; this

tool was not officially validated. Due to the manner in which the studies were conducted, additional study characteristics were analyzed across all nine studies.

Research design

Various research designs were used to measure the researcher's clinical questions. The researchers from eight studies conducted experimental research, of those eight, two were randomized control studies (Cioffi, Purcal, & Arundell, 2005; Daniels et al., 2010) and were the strongest representation of evidence to support this author's clinical question. There were two mixed- method designs featuring a before and after study along with structured qualitative interviews (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007). Observational study designs were less desired to support a clinical question but commonly used to evaluate the impact of an educational intervention. An observational before and after study was used by Crofts et al. (2007), Vadnais et al. (2011) and Cooper et al. (2010). Cooper et al. (2010) conducted a time series study along with their before and after study. The weakest form of experimental design was an observational non-controlled posttest study performed by Deering et al. (2009). There was also one qualitative study that supported the research question and was conducted using an ethnographic method (Limoges, 2009).

Sampling

The population of interest for the literature review was novice nurses with less than five years of experience working in obstetrics. All nine original research studies utilized the healthcare provider as subjects learning through simulation. The populations varied from medical and midwifery students (Birch et al., 2007; Crofts et al., 2007; Cioffi, Purcal, & Arundell, 2005; Deering et al., 2009; Vadnais et al., 2011) to baccalaureate and practical nursing students (Bambini, Washburn, & Perkins, 2009; Cooper et al., 2010; Limoges, 2009). Daniels et al.

(2010) were the only researchers that used labor and delivery nurses with less than five years of experience as their participants.

The researchers from seven studies chose a convenience sample and only two studies had a true random sample of subjects (Cioffi, Purcal, & Arundell, 2005; Daniels et al., 2010). The sample sizes ranged from 18 to 140 subjects. Significant attrition was not discussed in any of the studies. Four studies calculated their power analysis (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cooper et al., 2010; Crofts et al., 2007). Additionally, two studies were able to justify clinical significance with their sample size (Bambini, Washburn, & Perkins, 2009; Crofts et al., 2007).

Extraneous variables

The researchers in the nine studies did not mention placing control on extraneous variables nor did they identify what they were if they had encountered them. However, with simulation as an intervention there are five extraneous variables that should be considered when evaluating the effectiveness of the study results (Durham and Alden, 2008; Garrett, MacPhee, & Jackson, 2010; Jefferies, 2007). First, participants with previous exposure or experience with simulation education would have a greater advantage over those without. Second, researchers did not discuss performance anxiety of their participants which can be a barrier to their performance. Third, the researchers did not disclose details of the conversation that occurred between the participants and the simulator operator. The operator may need to vary his or her responses to maintain the authenticity of the simulation. Fourth, the process of how the researchers programmed the simulator was not mentioned. Reliability may be jeopardized when the simulator is not pre-programmed (Jefferies, 2007). Fifth, an orientation to the simulator was not discussed which may impact the performance of the participants.

Interventions

Researchers from all nine studies reported using simulation education but the structure of the simulation varied among them. The simulation time varied from five minutes (Deering et al., 2009) to two full days of training (Crofts et al., 2007). Two studies did not reveal the length of time that their participants were actually in the simulation (Cioffi, Purcal, & Arundell, 2005; Limoges, 2009). The studies also varied in the location of the simulator. Crofts et al. (2007) mentioned that they were evaluating whether having the simulator in the hospital versus a simulation center delivered a difference in results. Control groups were not used in the majority of the studies although two researchers did use control groups to compare the effectiveness of lecture, skill stations, or videos to simulation (Cioffi, Purcal, & Arundell, 2005; Daniels et al., 2010).

Adverse effects of intervention

Risks of simulation for the participant may include performance anxiety in front of his or her peers and feelings of inadequacy if the simulation scenario was not successful. None of the studies specifically addressed these adverse effects towards the participants. However, the qualitative study by Limoges (2009) reported feedback from her participants that anxiety was minimized by increasing the time the students could practice with the simulator.

Synthesis of Original Research

After analysis of the original research (Appendix A), there was evidence to support the clinical question which was to identify whether simulation education affects a novice nurse's situational awareness in an obstetrical emergency. Even though only one of the nine research articles focused on situational awareness (SA), the areas of confidence, knowledge, and clinical decision making all promote SA. The health professional, including novice nurses, demonstrated

an overall increase in self-confidence levels, knowledge scores, and clinical decision making skills after their simulation –focused intervention. The variety of research designs illustrated the popularity and infancy of utilizing simulation as a method of educating the healthcare professional. After review of the studies, more attention needs to be dedicated towards controlling extraneous variables and validating measurement tools to strengthen the quality of the research. The research consistently supported that self-confidence, knowledge level, and clinical decision making ability support one's situational awareness. Therefore, this author feels that simulation education can positively affect a healthcare professionals' SA in an obstetrical emergency.

Additional Evidence Related to the Clinical Question

Simulation may be used in educating nurses in the complexities of nursing practice such as patient safety, social disparities, diversity, and high risk – low volume patient situations. It is imperative to utilize guidelines for the use of simulation education in healthcare given the little research evidence that currently exists to guide nurse educators in using this teaching methodology. Guidelines were reviewed for both simulation education and the prevention and management of an obstetric emergency. There were no current national guidelines published for conducting or evaluating simulation. There were several systematic reviews that addressed the use of simulation for health professional's education. The national guidelines and systematic reviews were analyzed for relevance to this author's clinical question and system change project.

National practice guideline review

Two guideline review databases were searched. The search within the National Guideline Clearinghouse revealed one guideline for the prevention and management of Postpartum Hemorrhage (PPH) and none for simulation education. A search within the Cochrane Library

revealed one guideline each for the areas of simulation education and cesarean section. There were three guidelines found that support this author's literature review findings and system change project.

The first two national guidelines entitled, "Prevention and Management of Postpartum Hemorrhage" (Royal College of Obstetricians and Gynecologists, 2009) and "Cesarean Section" (National Collaborating Centre for Women's and Children's Health, 2004) provided recommendations for health conditions including the management of PPH and postoperative management after a cesarean section. These guidelines were developed using high levels of evidence; including meta- analysis, systematic reviews, and randomized- controlled trials. These recommendations were relevant to the obstetric practice setting as well as the simulation practice setting in order to prepare healthcare providers with evidence-based interventions.

The third guideline entitled, "The Development of Evidence-Based Clinical Simulation Scenarios: Guidelines for Nurse Educators" (Waxman, 2010) was designed specifically for nurse educators who wanted to develop clinical simulation scenarios. The developers provided guidelines that exemplified what educators may consider when writing and implementing scenarios in their practice setting.

Systematic reviews

There were four systematic reviews that had a similar research question; these studies evaluated the effectiveness of simulation as an education intervention for either the healthcare professional or pre-professional student on their confidence, knowledge, and / or clinical decision making ability. This was found primarily through database searches and reference lists. Databases included but were not limited to CINAHL, Medline, ProQuest, ERIC, PsychInfo, and Cochrane library; reference lists were reviewed for relevant original research and applicable

dissertations. The search terms included: adjuncts of "simulation," "evaluation," and "education;" and "teaching," "learning," and "clinical." The searches were exploded through MESH terms when necessary and revealed an initial result of between 61 and 10,903 references depending on their data range.

The studies were filtered based on the population, intervention, and research method. There was consistency among the systematic reviews in that the population was focused on either the healthcare profession or pre-professional healthcare student. The intervention in all of the systematic reviews was technology enhanced simulation. Additionally, the systematic reviews were selective towards the design in which the research was conducted.

Four reviews conducted an exhaustive search for the effectiveness of simulation as an educational intervention (Cant & Cooper, 2009; Cook et al., 2011; Harder, 2010; Laschinger et al., 2008). The authors filtered their search efforts with experimental and quasi-experimental studies first and descriptive and observational designs second. The authors were searching for the strongest level of evidence to support their clinical question. Given the paucity of strong experimental designs, the authors described their process of assessing validity of their research findings.

Cant & Cooper (2009) utilized the Critical Appraisal Skills Program (CASP) of the Public Health Resource Unit for their studies that were not RCTs. Cook et al. (2011) used the Medical Education Research Quality Instrument and the Newcastle-Ottowa Scale for evaluating methodological quality. Harder (2010) personally assessed her 61 studies for relevance to the defined inclusion criteria to determine eligibility; no formal tool was used. Laschinger et al. (2008) utilized two independent reviewers for quality assessment and the Joanna Briggs Institute System to define eligibility. Due to the type of designs and quality of available studies for these

four systematic reviews, Cook et al. (2011) were the only authors that provided a meta-analysis of their data. The data synthesis was otherwise described clearly in a narrative format.

The University of Oxford Systematic Review Appraisal Tool was used for Leschinger et al. (2008) to determine the quality of their systematic review. Each question of the tool was answered clearly in the systematic review except the question about whether the results were similar from one study to another. In the 23 studies analyzed there were differing results presented (Appendix C). This inconsistency was due to the lack of high quality research studies in simulation.

Key components of situational awareness (knowledge, confidence, and clinical decision making) were addressed in the systematic reviews. Of the twelve studies in the systematic review conducted by Cant & Cooper (2009), there were statistically significant improvements in knowledge and skills (45% of nine studies) and critical thinking ability and confidence (45% of eleven studies). Harder (2010) also disclosed that her systematic review had an increase in assessment and clinical skills and confidence levels. The variance in study findings reported by Cook et al.'s (2011) meta-analysis revealed inconclusive results of whether knowledge, skills, and learner behaviors were statistically increased. Leschinger et al. (2008) compiled mixed results on whether knowledge, skills, and confidence were increased. Cant & Cooper (2009) and Cook et al. (2011) both concluded from their study's results that simulation was an effective teaching and learning method. Cant & Cooper (2009) added that, "Simulation enables nurses to develop, synthesize, and apply their knowledge in a replica of real experiences" (p. 13). Laschinger et al. (2008) and Harder (2008) both stated that their results appeared to be inconclusive as to the effectiveness of simulation. As this pedagogy becomes more popular with

health care education, more needs to be explored in terms of how educators define simulation and utilize it for evaluating the participants.

Integrative Review

There were three areas consistently measured throughout all of the evidence for effectiveness of a simulation intervention. There was uniformity among most of the original research and systematic reviews regarding simulation having a positive impact on one's knowledge level, confidence levels, and clinical decision making ability which was also referred to as skill performance.

Knowledge

An overall positive increase in knowledge level was found in the evidence. The data was consistently gathered by a MCQ that was infrequently validated for that particular study. All of the studies' authors recognized that the lack of tool validation was a weakness of their study and an area that needed further exploration. Data from the MCQs were then evaluated by either ANOVA or a t-test. The meta-analysis (Cook et al., 2011) revealed that knowledge scores did increase but did not show consistently statistically significant results which may have been partially due to the lack of validated measurement tools. Leschinger et al. (2008) reported results that varied depending on the type of simulator the participants were being tested on and therefore was not able to conclusively decipher whether knowledge levels were improved.

Confidence

Confidence levels were also consistently reported as positive as a result of simulation training. Data was typically gathered by a survey or questionnaire using a Likert scale and evaluated by a t-test. There were two systematic reviews (Cant & Cooper, 2009; Harder, 2010) and several independent original research studies that revealed positive findings for confidence

after simulation interventions. There was however, one systematic review that had inconclusive results for whether confidence levels were increased after simulation (Leschinger et al., 2008). Leschinger et al.'s (2008) systematic review had inconclusive results for confidence levels and the authors attributed that to the type of simulation the participants were involved with. The study did produce anecdotal comments that were positive regarding confidence levels. Cook et al.'s (2011) systematic review did not specifically look for confidence levels.

Clinical decision making

Clinical decision making ability was reported with positive outcomes in many of the articles of evidence. Clinical decision making ability was also defined as "skill performance" and "learner behavior" in several of the studies within the systematic reviews. The majority of the studies used a unique tool that was created just for the specific study. There was no consistency with what kind of tool the researchers were using across the studies in part due to how the researcher had defined "clinical decision making" or "skill performance." None of the evidence revealed that their measures for clinical decision making were validated.

Summary

The theoretical frameworks of Kolb, Orlando, and Endsley are embedded within simulation education and supported this SCP. The literature review provided an overview of how simulation enhances one's confidence, knowledge, and clinical decision making ability and how it is being utilized in the health care setting. Chapter three will describe this SCP's evidence-based design and methodology. The project's implementation plan and use of resources will also be discussed.

Chapter III

The following chapter provides an overview of the SCP design and methodology. A description of the project's implementation plan and the resources utilized for the SCP are discussed. The financial implications for this project as well as the cost and benefit analysis are outlined. Additionally, the ethical considerations for implementing the project are examined.

Project Design and Methodology

Situational awareness is very challenging to measure as revealed by the literature review. The literature review revealed that there were no tools that had specific psychometric testing to ensure that they were effectively measuring SA for the bedside nurse. Consequently, after the simulation intervention, the latent variable of SA was evaluated on whether nurses had (1) a gain self –confidence, (2) an increase in their knowledge of indicators that identify patient deterioration, and (3) demonstration of effective clinical decision making skills during a high fidelity simulation workshop. Knowledge and confidence were measured by a questionnaire (Appendix D, E) given to the participants before their simulation case study and then after their simulation and debriefing exercise. Clinical decision making was evaluated by the researcher during the simulation (Appendix F).

Implementation Plan

Details of the study participants and timeline are discussed below as well as the technology that was used for the simulation. A ridged timeline was created to keep all participants and volunteers on task. Furthermore, the resources and support from both the hospital and the university are described further.

Participants

The participants for this study were recruited by the obstetric unit's educational specialist at Mayo Clinic Health System- Franciscan Healthcare (MCHS-FH). The study participants were required to have less than five years of experience in obstetric nursing in order to qualify for participation in the project. The educator also desired her newest nurses to the obstetric unit to undergo educational training in an emergency situation. She invited ten novice nurses that consented to participate in the study. The participants in this study were all female and all had less than two years of experience. Therefore, this was a convenience sample that was selected by the nurse educator as a part of a mandatory staff development activity. The nurse participants had the option to decline taking part in the before-and-after study even though the simulation education was required.

Timeline

Nurse participants were initially notified about this project by the unit educator and director. To promote the acceptance of this change in educational methods, a brief information session at the obstetrics unit meeting was facilitated by this researcher. An overview of the project's educational method, benefits and risks for the novice nurses, and the potential impact on patient outcomes were presented. The unit educator posted a sign- up time sheet for the simulation day and the participants were able to sign up in pairs of two.

The project took place at the university's simulation center. Each nurse participated in the education session including a simulation, debriefing session, and pre and post assessment questions. Once participants consented to participate, they were asked to fill out the questionnaire (Appendix E). The participants were then scheduled to receive a 20 minute orientation to the simulation center. Following their orientation, the paired nurses participated in

a 20 minute simulation scenario. The nurses then shared their thoughts and experience in a 30 minute debriefing session facilitated by nurse educators. The nurses finished their commitment to the study by completing the post assessment questionnaire. The estimated time commitment for participants was approximately three hours.

Resources

The resources for this clinical project were outlined and included: personnel needed to implement the project, technology descriptions, budget and return on investment. In addition, support from the community facilities as well as ethical considerations were addressed and are discussed below.

Personnel

Viterbo faculty, including the Simulation Coordinator and a maternity assistant professor, were utilized as content experts for assisting with the simulation development. A work study student assisted in the simulation laboratory for set up and take- down of supplies. These individuals were vital to the project for their expertise in equipment management and maternity nursing care.

MCHS-FH also had individuals that assisted with competency training in the hospital. The Hospital Nursing Education Coordinator, Maternity Education Specialist and three obstetric nurses assisted with the fidelity of the simulation and the debriefing components. The Hospital Nursing Education Coordinator also assisted in requesting an education grant from their foundation.

Technology

There were many components to this project that required state of the art technology. The hosting simulation center was a new building designed to simulate many different hospital settings and one room specifically as a labor and delivery hospital suite.

The labor and delivery suite was designed to appear as though the MCHS-FH nurse was working in an environment that looked and felt just like the real hospital setting. There was consideration for the room set up including: orientation of the bed, intravenous equipment, nursing protocol and documentation worksheets, bedside monitors, tables and what should be inside the tables. Additionally, there was a working telephone with phone numbers that called the necessary personnel placed at the bedside. This author, the MCHS-FH educators, and the simulation coordinator worked through these details meticulously to increase the fidelity of the simulation.

Advanced technology, 'Noelle' S575 by Guamard, was used to provide nurses the opportunity to practice and simulate an array of obstetric situations. This project was designed to simulate a post cesarean section hemorrhage. Noelle was programmed to express verbally and physically the signs and symptoms of a typical mother who is actively hemorrhaging. Noelle was also programmed to respond to the nurse's interventions in 'real-time', whether that meant for her condition to improve or decline. Noelle's scenarios were preset but were also manipulated by the simulation coordinator to activate her "voice" in response to the nurse's questions and to advance the simulation in response to interventions.

Additionally, an electrocardiogram (ECG) monitor, a component of Noelle's software, was used to visualize Noelle's heart rate. There were key moments throughout the simulation when Noelle's heart rate either increased or decreased giving physiologic signs for the nurses to

respond to. The heart rate changes were programmed into Noelle's software and then visualized by the nurses on the monitor in the simulation suite. There was also a "telemetry technician" assigned to watch Noelle's status remotely; this technician responded to elevated heart rates by calling the "nurse on duty" in the simulation suite. The ECG monitor was an essential piece of technology for the nurses to evaluate Noelle's status and provide appropriate interventions.

There were many pieces of supportive technology utilized throughout the simulation. "Effective simulation should mimic reality as much as possible including access to the same tools and resources the participants would have in an actual healthcare setting" (Garrett, MacPhee, & Jackson, 2010, p. 310). In order for the nurses to perform basic assessments and provide basic care for Noelle there was equipment located in the labor and delivery simulation suite. The available equipment included: maternity hospital bed, temporal-artery thermometer, sphygmomanometer, infant scale, sequential compression devices, and an oxygen source.

Noelle was programmed to need intravenous (IV) fluids and therefore IV infusion pumps were used to infuse hydrating fluids as well as IV drip medications and IV push medications. The nurses chose to give 'Noelle' medication as one of their interventions. In order to access that medication the Pyxis medication storage system was used. The nurses in this simulation were not fingerprinted to access the medication; however, the medication was located at the Pyxis station to aid in the fidelity of the simulation.

There was also a basic telephone hooked up in the simulation suite. This phone was how the telemetry technician communicated with the nurses when Noelle's heart rate increased to a certain level. The nurses also used this phone to call the "charge nurse" for assistance and the "doctor" for further patient orders as directed by the patient protocol. The phone numbers for these individuals were posted next to the phone.

The center's debriefing room was a conference room with a one-way mirror and intercom into the simulation suite. There were nurse educators and the "charge nurse" confederate watching and evaluating the simulation exercise from this room. The debriefing room was where the educators discussed how the simulation was proceeding, made notes, and responded to requests for help from the nurses without being a visual distraction during the simulation. The debriefing room did not have video or audio capture capabilities at the time of the study; therefore the simulations were not recorded in any way for playback. After the simulation exercise the educators and nurse participants discussed the simulation events, protocols, and asked questions in the private atmosphere of the debriefing room.

Cost and Benefit Analysis

As the use of simulation technology is integrated into nursing education and nursing practice, the need for exploring the cost and benefit of this technology is necessary. From a financial point of view, there was a paucity of data that demonstrated that a high-fidelity simulation center offers more benefit than a standard mannequin and laboratory for educating nurses. A simulation center may be too expensive for one facility to justify the need (Harlow and Sportsman, 2007; Schiavenato, 2009). However, with collaboration of resources, the financial commitment of a simulation center may become more manageable

Economic issues

In the small city for which this project took place there was a surplus of practicing bedside nurses and nursing students. Unfortunately there was a shortage of prepared nurse educators to match all of the educational needs of the nursing community. Both the university and the hospital employed nurse educators. This was a collective body of nurse educators that would work together in: the discovery of new nursing knowledge, sharing educator

responsibilities of their discipline and in implementing and advocating for evidence based practice. Collaboration between nurse educators from the hospital and university is a smart economic choice for all those in this community.

There were economic issues for the university and the hospital. The university had made a commitment to purchase, maintain and upgrade the hardware and software technology, simulation supplies, and overall fidelity of the center. The university also had an obligation to offer faculty training and provide opportunities for scholarly involvement. Collaboration would offer the opportunity for revenue to help with the upkeep and training in the simulation center. The hospital had a responsibility to maintain its nurses' competency level to provide excellent patient care regardless of their prior experience. Additionally, patients expected excellent care regardless of how much experience a nurse had or how emergent and rare their situation was. The rarity of the patient situations created difficulty in training all nurses, especially novice nurses. Exposure in a simulation environment offered an opportunity for nurses to build skills and clinical decision making ability for high acuity situations.

Project cost

Cost effectiveness that may result as a benefit of this SCP was considered. Financial details necessary to conduct this SCP were analyzed and the components to organizing simulation education were itemized. The costs for both the university and the hospital are discussed further (Appendix G).

The total estimated package of the simulation center was greater than $270,000.00 for the university (C. Wilson RN, MSN, personal communication, September 2012). The estimated cost of the simulation center not in use, twenty percent of total cost, was $67,500.00 (C. Wilson RN,

MSN, personal communication, September 2012.). Therefore there was an indirect cost for not renting out the simulation center and an incentive to generate collaboration.

The hospital also had a financial commitment. The hospital needed to consider the cost of educating their nurses outside of their facility. The fixed and variable costs included: rental of the simulation center, wages for the staff being trained, the backfill of staff working on the floor, the principal investigator of this project and the educator's time for the preparation and simulation day. Additionally, to create an authentic atmosphere, props and hospital supplies were necessary. The hospital was asked to provide some of the unique props for their staff's experience. The estimated project cost to the hospital was $8,616.00.

Project benefits

Both facilities benefited from the collaborative educational experience. The benefits for the university, hospital, and community are discussed below (Appendix H) and included financial incentives, staff nurse education and community benefits.

The university gained financial support for the simulation center in order to preserve basic operation and availability to its students and community. The estimated financial gain from each rental is $2,575.00. The university was planning to reinvest the funds gained by renting their space for quality improvement measures and advancing and updating the center as needed.

The hospital may gain highly educated and trained novice nurses which could hopefully lead to improved patient outcomes and prevention of obstetric emergencies. These emergencies could lead to lengthened hospital stays, need for further hospital services, and perhaps an increase in overall obstetric surgeries and intensive care which inevitably incur greater cost to the hospital and patients. Additionally, educating nurses outside of the obstetric unit instead of utilizing a patient room for training creates availability for increased census and reduces

disruptions to care delivery on the unit. The estimated financial gain for the hospital was $28,600.00. The estimated return on investment for the hospital was 232% (Appendix H).

The community gained tangible benefits and utility from this collaboration. Professional collaboration may serve to advance nursing knowledge, interdisciplinary care, and care coordination skills. It may even offer an opportunity for new nurse graduates to have an improved mentoring or orientation program which would lead to a smoother transition into practice. Expanding the use of technology to improve the delivery of safe quality care is important to the future of nursing (Ellerbe & Regen, 2012). These benefits align with recommendations from the 2010 IOM's *The Future of Nursing* report (IOM, 2011) including the goal of utilizing higher levels of education and training in an improved education system. Furthermore, the success of this educational collaboration may demonstrate to nursing students in the community the power of teamwork and collegiality.

Ethical Considerations

The Institutional Review Board's (IRB) approval was obtained from St. Catherine's University (12-N-26) (Appendix J), Mayo Clinic Health System- Franciscan Healthcare (Appendix L), and Viterbo University (Appendix K) before conducting this educational session for the maternity nurses. The proposed project was determined to be exempt from Human Subject Review Board as it was viewed as an educational project and involved minimal risk to the subjects involved. Participants were not excluded based on gender, race, ethnicity, sexual orientation, or age. Participant confidentiality was maintained and consent was obtained. Additionally, the overall ambition of the system change project was to improve patient outcomes through highly educated and trained nurses.

Confidentiality and consent

Confidentiality of the participant's study results was explained to the participants in their consent form (Appendix I). The participants were given a number to identify their paperwork throughout the study day; the number was not associated with a name in any way. The anonymous data and notes were handled and discussed for analysis only by the statistician, project advisor, and project researcher.

Participants gave consent by completing the pre and post-assessment questions. Participation in the survey aspect of this study was voluntary. An explanation was given to clarify that their decision whether or not to participate would not affect their future relations with Mayo Clinic Health System – Franciscan Healthcare La Crosse in any way. Furthermore, if they decided to participate, they were free to stop at any time without affecting these relationships.

Risks and benefits of simulation

The risks of the simulation intervention in this SCP were similar to those found in the literature (Durham & Alden, 2008; Jeffries, 2007). Risks for the participant included performance anxiety in front of their peers and educators and feelings of inadequacy if the simulator scenario was not successful. Additional risk avoided was the inherent risk to a patient population because they were not involved in anyway.

The direct benefits of participating in the simulation intervention were the potential for an increase in knowledge and understanding in the management of an obstetric emergency and an opportunity to enhance situational awareness in a critical event. Additionally, the participants would be able to use that enhanced knowledge and skill towards future obstetric emergencies with real patients.

Improved situational awareness could then benefit each and every one of their future patients. Consideration was given to the potential risks of this study but the benefits of participants agreeing to be involved with this study greatly outweighed the risks mentioned above.

Survey Tools

Survey tools for before and after the simulation exercise were developed and used to evaluate the nurse's confidence and knowledge levels, clinical decision making ability, and situational awareness (Appendix D, E, F). The confidence, knowledge, and situational awareness tools were self-evaluation surveys. Researchers commonly used a self-assessment tool specific to their study (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005; Limoges, 2009) to evaluate both confidence and knowledge. The Nurse Confidence Survey for this study included a five point Likert scale that measured the nurse's confidence in their assessments and interventions from a "1" (strongly confident) to a "5" (strongly unconfident) in six different areas of obstetric nursing. The Nurse Knowledge Survey included multiple choice type questions that measured background knowledge of basic obstetric nursing in eight questions. Literature supported the use of a multiple choice questionnaire (Birch et al., 2007; Cooper et al., 2010; Crofts et al., 2007; Vadnais et al., 2011) and did not have a consistent number of questions for the questionnaire.

The Clinical Decision Making tool, Critical Benchmarks (Appendix F), evaluated the nurses on whether they 'met' or did 'not meet' critical benchmarks in the simulation which demonstrated their critical thinking ability and was completed by the SCP facilitator. For purposes of this SCP, a 'met' or 'not met' of the critical benchmarks during a Postpartum Hemorrhage (PPH) was recorded at the time the participant demonstrated completion of the pre-

set benchmark. The Clinical Decision Making benchmarks were set for three different time periods within the simulation. The first benchmark, 'recognition of early signs of postpartum hemorrhage', was set at five minutes into the simulation scenario. This benchmark included identifying early signs of PPH which were: complaints of nausea, increased heart rate, small amounts of lochia, and a firm fundus. The second benchmark, 'recognition of signs of postpartum hemorrhage', was set for five to ten minutes into the simulation. This benchmark included identifying signs of PPH which were: tachycardia, moderate amounts of lochia, and a slightly boggy fundus. The third benchmark, 'recognition of late signs of postpartum hemorrhage', was set for ten to fifteen minutes into the simulation. This benchmark included identifying late signs of PPH which were: tachycardia, hypotension, large amounts of lochia, and a boggy fundus.

Additionally, the Situational Awareness Assessment tool was a multiple choice questionnaire that assessed the nurse's perception of the critical event after the simulation exercise. The SA questions were developed based on the three components of Endsley's Theory of Situational Awareness. Questions were written to assess the participant's background knowledge, current awareness of patient condition, and future prediction of patient status.

Summary

In summary, this chapter discussed the system change project's design, methodology, and implementation plan. The project timeline, financial implications and resource utilization were also provided. The following chapter will offer the results specific to the system change project.

Chapter IV

The System Change Project (SCP) was developed to address the situational awareness of novice obstetric nurses. The project work investigated whether simulation education increased the subject's confidence level, knowledge level, critical thinking ability, and therefore situational awareness. The results of this SCP are presented in this chapter.

Data Analysis

Sample

A total of ten nurses participated in the simulation study. They were all women between the ages of 21 and 35. Three of the ten (30%) had prior experience in a simulation lab. All of the women worked on an obstetrics unit and were considered novices (less than 5 years of experience).

Survey Results

The Nurse Confidence Survey and the Nurse Knowledge Survey were evaluated separately by a t-test to determine statistical significance ($p<0.05$). The Critical Thinking Assessment and Situational Awareness Assessment were not a comparison study and therefore the results are described based on post-test survey results only. A statistician was hired for assistance with statistical analysis of the data.

Nurse Confidence Survey

The Nurse Confidence Survey measured the novice nurse's confidence in assessments and interventions for obstetric patients in a critical situation. There were six questions on the survey that addressed confidence (Table 4.1). Confidence levels improved in 60% (N=6) of the participants from a "2.5" mean level to a "1.83" mean level and declined in 40% (N=4) of the participants from a "2.05" mean level to a "2.3" mean level after the simulation. A t-test was

used to determine if the participant's confidence level differed after the simulation. These differences were statistically significant (p=0.0231). Findings showed that overall the nurses did increase their confidence levels after the simulation experience. There were increases in confidence levels by at least one point for at least three participants in "Knowing how to respond to early signs of PPH" and "Handling unfamiliar situations in an emergent condition." Four participants had increased confidence in "Recognizing the signs of PPH," "Knowing when to call additional help," and in "Differentiating a contracted uterus from a non-contracted uterus."

Table 4.1 Confidence Assessment Questions

Participants rated their confidence level by answering the following questions with "Strongly agree (1) to strongly disagree (5)" before and after the simulation.

Questions

"I have:"

1. Confidence in recognizing the signs and symptoms of postpartum hemorrhage.
2. Confidence in knowing how to respond to the early signs of postpartum hemorrhage.
3. Confidence in knowing when to call for an additional nurse for help.
4. Confidence in handling unfamiliar situations in which a patient appears to be manifesting symptoms from an emergent condition.
5. Confidence in applying the patient care protocol for a patient experiencing signs and symptoms of postpartum hemorrhage.
6. Confidence in differentiating a contracted uterus from a non-contracted uterus.

Nurse Knowledge Survey

The Nurse Knowledge Survey measured the novice nurse's knowledge level in PPH and medication administration in eight multiple choice questions (Table 4.2). Knowledge levels improved in 10% (N=1) of the participants, evidenced by the participant's score increasing from a 50% to 62.5% after the simulation. There were several participants 50% (N=5) who had no change in knowledge level evidenced by their scores staying the same before and after simulation, scores ranged from 50% correct to 87.5% correct. Furthermore, 40% (N=4) of the participants dropped their knowledge level evidenced by scores ranging from 75% to 100% correct down to 50% to 87.5% correct. A t-test was used to determine if the participant's

knowledge level of PPH care differed after the simulation. These differences were not statistically significant (p= 0.9114).

Table 4.2 Knowledge Assessment Questions
Participants rated their knowledge level by answering the following multiple choice questions.
Questions
1. A nurse caring for a postpartum mother understands that which of the following findings are the earliest indication of hypovolemia caused by hemorrhage? A. Increased pulse and decreased blood pressure B. Dizziness and increased respiratory rate C. Cool, clammy skin, pale mucous membranes D. Altered mental status and level of consciousness
2. During a postpartum assessment, the nurse finds a large amount of rubra lochia on the mother's perineal pad. The fundus is midline and firm at the umbilicus. Which of the following actions should be taken? A. Document the findings and continue to monitor the mother B. Notify the provider C. Massage the mother's fundus frequently to contract the uterus D. Administer Pitocin 10 units IM once
3. The nurse is assessing a postpartum mother who was prescribed methlergonovine (Methergine). The nurse knows that the medication was effective when the mother has: A. A firm fundus B. A rise in blood pressure C. An increase in lochia D. A decrease in breast discomfort
4. Maternal blood loss is usually: A. Underestimated B. Accurately assessed C. Overestimated D. Inaccurately assessed
5. The most common cause of maternal intrapartum death is: A. Preterm labor B. Hemorrhage C. Embolism D. Hypertension
6. Pitocin can be administered A. IV push B. Rectally C. Sublingually D. Titrated infusion
7. The most common cause of postpartum hemorrhage is A. Vaginal laceration B. Uterine atony C. Retained placental tissue D. Perinea hematoma
8. Hemabate may cause which of the following side effects? A. Nausea B. Vomiting

C. Diarrhea D. All of the above

Clinical Decision Making tool "Critical Benchmarks"

Clinical decision making ability was assessed by the researcher based on whether the participants met the pre-set benchmarks (Appendix F). The benchmarks were set at 5, 10, and 15 minute timeframes during the simulation. None of the participants met the first two benchmarks. All ten participants met the third critical benchmark within the ten to fifteen minute time frame which demonstrated clinical decision making ability.

Situational Awareness Assessment

Situational awareness indicates a nurse's ability to assess the patient's presenting symptoms, survey their current situation and environment, and then intervene based on their background knowledge of how the patient condition may change. There were five multiple choice questions on the Situational Awareness Assessment that addressed their situational awareness of the simulated situation (Table 4.3). The first two questions assessed their awareness of the patient's presenting symptoms, 80% (N=8) of the participants answered at least one of the questions correctly. The second two questions assessed the nurse's awareness of the current situation and environment, 90% (N=9) of the participants answered at least one of the questions correctly. The last question assessed the nurse's ability to predict the patient's changing condition; this was a multiple-selection type question and 80% (N=8) of the participants answered it completely correct with the remaining 20% (N=2) that answered it partially correct.

Table 4.3 Situational Awareness Assessment Questions
Participants rated their situational awareness by answering the following multiple choice questions.
Questions
What was the main change in vital signs at the beginning of the simulation? A. Pulse increased B. Blood Pressure decreased C. Temperature increased D. Oxygen saturation decreased

What was the initial complaint that the patient verbalized that alerted you to a potential problem? A. "My peri pad feels wet." B. "I feel upset to my stomach." C. "My breasts feel very full and achy." D. "I feel like my heart is beating really hard."
. What was the most likely cause of your patient's emergency? A. Hypervolemia due to blood loss B. Uterine atony C. Pulmonary embolism D. Cesarean section
. What resource did you access first when you realized the patient's emergent condition? A. A nurse anesthetist B. The postpartum hemorrhage kit C. A second nurse D. The postpartum protocol
. How will your patient's condition change in the next fifteen minutes due to your use of the available resources? *Please select all that apply.* A. Her vitals will stabilize. B. Her bleeding will slow down. C. Her fundus will be midline and firm. D. She will return to surgery for a hysterectomy. E. She will be restricted from breast feeding until Hemabate and Oxytocin wear off.

Summation of Surveys

As a collective group there was not statistical significance generated from the surveys to say that SA was increased after the simulation. All of the components of SA were tested during this project and the results varied among the individual participants. Table 4.4 summarizes the overall results of the surveys. There was one participant that demonstrated an improvement in all three categories which by definition in this study would indicate that she had improved her situational awareness. The following participant situations did not demonstrate a gain in SA by definition. Two participants had no change in knowledge scores but increased their confidence level and met the critical thinking benchmarks. Three participants had no change in their knowledge level, had an increase in their confidence level, and met the critical thinking benchmarks. Three participants had a decrease in their knowledge scores but an increase in their

confidence levels and met the critical thinking benchmarks. The remaining participant showed evidence of decreasing knowledge and confidence levels after the simulation but met the critical thinking benchmarks. Even though 90% (N=9) of participants did not gain SA by definition, they found value in the experience as evidenced by their anecdotal comments.

Table 4.4 Overall Results from Surveys

Number of Participants	Knowledge Levels (K)	Confidence Levels (C)	Clinical Decision Making Ability (CDM)	Situational Awareness (K + C+ CDM)
1	Improvement	Improvement	Met	Yes
2	No change	Improvement	Met	No
3	No change	Decrease	Met	No
3	Decrease	Improvement	Met	No
1	Decrease	Decrease	Met	No

Anecdotal Comments

Anecdotal comments from the participants were collected regarding: the most valuable aspect of the simulation day, the least valuable aspect of the simulation day, the use of simulation in nursing education, whether the debriefing after the simulation was supportive, and their recommendations for future nursing programs with simulation. The questions were designed for open-ended responses so that the participants could offer individual comments (Appendix E). Specific comments from some of the participants were included.

Summary

In summary, the results showed that the participants had a wide range of variability in terms of their knowledge and confidence levels after the simulation. The participants all met the final critical benchmark in the simulation that demonstrated the participant's clinical decision making ability. Additionally, the majority of the participants answered all three components of the situational awareness questions correctly demonstrating their possession of situational awareness. The following chapter discusses the findings and implications from the study results.

Chapter V

The following chapter discusses the study results and participant's anecdotal comments gathered for this Systems Change Project. Limitations and recommendations for future practice will be identified. Implications for healthcare as well as the Doctor of Nursing Practice leadership role will conclude this chapter.

Discussion

This author along with the hospital educators believe that improving the Situational Awareness (SA) of their novice obstetric nurses will lead to overall improved patient outcomes. High-fidelity simulation technology has generated opportunities to create realistic simulations during which nurses can develop the components of SA (confidence, knowledge, and clinical decision making ability) without endangering real patients. The SCP was a pilot investigation into the effectiveness of high-fidelity simulation to improve a nurse's situational awareness in an obstetric emergency as preparation for experiences with live patients. Data analysis indicated that simulation education had an impact on the participants' confidence levels, knowledge levels and clinical decision making ability.

Confidence

Self-reported confidence levels increased for many of the obstetric assessment and intervention areas assessed on the survey. The participants commonly showed an increase in confidence in assessing the fundus. These results were expected and reflected what was found in Bambini, Washburn, and Perkins (2009) research as well. The studies reviewed for the implementation of this project also reported an overall increased confidence level in their participants (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005; Vadnais et al., 2011; Limoges, 2009). Quality simulation exercises should

develop a participant's confidence in the care of patients. Experiential Learning Theory sustains that increased patient exposure, even through innovative clinical experiences, aid in the development of clinical confidence.

After the simulation, there were five participants that had a decrease in confidence by one point; there was not a specific question that provoked a decrease in confidence level. None of the studies reviewed for this project had this result. The Experiential Learning Theory would support this change in confidence, even though it showed a decrease, because it reflects that the participants were engaged in the learning exercise, challenged by their previous knowledge base, and this therefore created some discomfort. It is the breakdown of the knowledge during an experience which allows for the building of future concepts (Kolb, 1984).

Knowledge

An unexpected finding was the lack of significant positive change between the pre and post simulation knowledge test scores. Only one participant answered all of the questions correctly on the pretest so there was room for improvement with 90% of the participants. There was one participant that did increase her knowledge test score from a 50% to a 62%. Five of the participants had no change in their test scores and their scores ranged from 50% correct to 88% correct.

Most surprisingly, four participants decreased their test scores from their pretest; three of those four changed one answer to be incorrect while one participant changed three answers to be incorrect from their pretest. These findings were not consistent with the reviewed literature which all showed an increase in scores (Bambini, Washburn, & Perkins, 2009; Birch et al., 2007; Cioffi, Purcal, & Arundell, 2005; Vadnais et al., 2011; Limoges, 2009).

One explanation of these findings may be attributed to the lack of validated measurement tools in this study. The use of non-validated tools may result in inconsistent results (Melnyk & Fineout-Overholt, 2005). Another explanation may be attributed to the Theory of Cognitive Dissonance. The theory states that when participants are presented with two incongruent realities they experience discomfort and distress (Meyer & Xu, 2005). "Instead of the academic ideal in which they have so much invested, they face a contrasting clinical reality they do not understand and cannot avoid" (Meyer & Xu, 2005, p. 77). Therefore, the nurses may have realized that they were unprepared for certain emergencies or that their current knowledge was insufficient. Their response, then, may have been to second-guess themselves and to change answers to perform poorly on the knowledge items.

Clinical Decision Making

The clinical decision making benchmarks were set up in different stages of presenting of post-partum hemorrhage. The simulation program was designed to present: 'early signs of PPH', 'mature signs of PPH', and 'late signs of PPH', all at different times during the simulation scenario. All of the participants met the third benchmark of recognizing how to respond to PPH by the third benchmark, which were late signs of PPH. The late signs of PPH were evident to participants at 10 to 15 minutes into the scenario.

Seven of the ten participants were new to a simulation learning environment which may have contributed to them not recognizing the early or mature simulator's signs in a timely manner. Additionally, the nurses were all novices, with experience less than five years, and may have never seen a PPH scenario either real or simulated to know all of the signs to look for. Hence, these results communicated the need for an educational intervention and that postpartum emergencies were a key area to focus on for novice nurses.

Anecdotal Comments

The nurses provided feedback regarding their most valuable aspect of the simulation day. Common responses included the appreciation for the "hands on experience" and an "opportunity to build confidence" referring to the exposure to the critical obstetric event. The nurses also mentioned that they valued the "feedback following the scenario", the "reality of the scenario", and "practicing in a controlled and safe environment." These comments were consistent with findings from the literature which offered comments about debriefing and critical reflection, learning in a safe environment, and the value of peer and educator feedback (Jeffries, 2007; Lasater, 2007; Kaddoura, 2010).

There were very few participants that offered feedback towards the least valuable aspect of the simulation day. The responses focused on the desire to "have more familiarity with the environment" and "more experience with the equipment set up" which may have helped to decrease "anxiety during the simulation." Even though the nurses were given a twenty minute time allotment towards orientation to the simulation environment, none of the nurses took full advantage of that time. They expressed comfort to the simulation coordinator after ten minutes of explanation of the simulation environment. Additional comments were collected regarding the use of simulation in nursing education, the effectiveness of debriefing and recommendations for future simulation programs.

Simulation in nursing education

The participants all offered positive feedback regarding the use of simulation in nursing education. They collectively responded with enthusiasm for simulation to be incorporated into future learning opportunities. One participant stated that "it is a great tool to help with my critical

thinking skills." There were several participants that felt it was a great way to "practice" and "learn in a safe environment" before managing a real critical emergency.

Debriefing

The discussion following a simulation is a critical learning time and is meant to be supportive and collegial. All ten participants agreed that the debriefing session and feedback following their simulation scenario was very useful and supportive. Discussions were allotted thirty minutes and were robust. One commented how great it was to have a "professional conversation with knowledgeable educators and my peers" concerning their emergency experience. Another commented on how much was learned by "talking with everyone about ways to respond quickly and efficiently" and "it helps to see things from another perspective".

Participant feedback in previous research included statements such as, "debriefing sharpened my critical thinking skills" (Kaddoura, 2010, p. 511) and "I was able to step back and think about what I should have done" (Lasater, 2007, p. 274). The root of Experiential Learning Theory is embedded in the comments from the participants. The participants experienced a new emergency situation, reflected on their performance, developed new concepts regarding the emergency and then were able to discuss how they would use this new knowledge in future practice. The review of literature by Rourke, Schmidt, and Garga (2010) found a similar connection between simulation, debriefing, and Kolb's Learning Theory.

Recommendations for future simulation programs

One of the intentions of this SCP was to advance and expand the use of simulation programs at this hospital. The participants offered three suggestions to consider for future programs. They requested a more detailed orientation to the simulation laboratory to help with familiarity. The participants desired a packet of information to preview so that they could be

more prepared coming into the simulation. Additionally, they requested to learn through high-fidelity simulation more often so that they become more comfortable with the environment.

The SCP was created on a small scale in order to get constructive feedback before moving forward to larger populations. All of the comments will be taken into consideration for future simulation program development.

Limitations

The small sample size of this SCP was determined by the logistics of the simulation center such as space, number of faculty, time, and resources. The study was implemented within a single department of a smaller sized healthcare organization and therefore, not suggestive of system wide results. Another limitation was that the researcher had little control over which nurses participated in this study. The obstetric educator selected the nurses based on the criteria given to her, but was subject to their availability on the study day. The small and heterogeneous sample size (N=10) of this SCP was a limitation. The findings were subject to Type II errors as a result of a small sample size and lead to uncertainty that the difference observed is real. Limited sample size may result in inaccurate results and impact the strength of a study (Melnyk & Fineout-Overholt, 2005).

It is also recognized that high-fidelity simulation is a newer method of education and very few new healthcare providers have trained in this manner. Durham and Alden (2008) reported in their literature review that some researcher's results showed participant feelings of apprehension, uneasiness, and initial anxiety. The participants in this study also reported having some anxiety during the simulation. The lack of exposure to the simulated environment may have produced some performance anxiety and affected the level of critical thinking of the healthcare provider. This heightened level of anxiety may be considered a limitation; however, the level of anxiety

may also be compared to the level one would have in a real critical event. Perhaps the anxiety the participants reported was actually their "immediate reaction" to the "presenting behavior of the patient" (Schmieding, 2006). The immediate reactions of a nurse to the presenting signs of the patient are components of Orlando's Nursing Process Theory (Schmieding, 2006). Therefore, the participant's anxiety may have been derived from the simulator's emergency. Anxiety related to simulation training, similar to bedside critical event training, may be dampened through repeated exposure, a detailed orientation, and a relaxed approach by the facilitator (Durham and Alden, 2008; Jefferies, 2007).

Additionally, the concept of Situational Awareness in the healthcare setting is relatively new and there were no validated tools for measurement in a healthcare simulated situation (Wright, Taekman, and Endsley, 2004). The lack of validated tools in this SCP was another limitation. Based on recommendations from Wright, Taekman, and Endsley (2004) and Flin and Maron (2004) and Endsley (1988), this author chose to combine three areas of evaluation to predict the latent variable of SA. These authors found in their research that confidence, background knowledge, and clinical decision making ability are all components of SA. Further research designed to examine the effect of high-fidelity simulations on SA in critical situations, using larger samples and more rigorous data collection strategies, is needed.

Recommendations

The healthcare system in the United States will experience a nursing shortage estimated at 260,000 full time nurses by 2025 (Brunell & Ross, 2012). Critical to increasing the nursing workforce is the successful training of novice nurses in the work setting and increasing the competence of those already in nursing to decrease attrition. Additionally, there are a great number of errors that occur in healthcare. Simulation would be a great teaching tool to help

reduce medical error by reinforcing processes, strengthening teamwork, and reinforcing communication techniques. Through the American Recovery and Reinvestment Act of 2009 (ARRA), the Health Resources and Services Administration (HRSA) dedicated $200 million to expand training within the healthcare profession (Brunell & Ross, 2012). Increasing specialized training and dedicating educational resources for nurses may help produce a staff with more competent nurses.

Collaboration between a simulation center and a hospital system offers innovative educational opportunities. The SCP serves as a model for all educators for advancing educational methods for healthcare professionals. Simulation challenges nurse educators to offer their nurses a deeper way of learning. Simulation enhances both clinical and non-clinical skills for nurses. This new skill set may be utilized in many kinds of patient care situations. There are acute care training capabilities as discussed in this SCP and alternative training situations such as chronic disease and home care management, rural nursing, and patient teaching situations. Doctorally prepared nurse educators may be in unique leadership positions to enhance education for healthcare staff and facilitate the development and implementation of formal simulation programs.

This study does not go as far to evaluate the nurse participants with real patients after enhancing their SA through simulation. However, simulation does offer new and exciting research opportunities. There are opportunities to research both the clinical and academic uses of simulation. It will be imperative to establish tools for measuring change and an agreement about terminology used in simulation so that the results produced by the research have validity.

The ultimate evaluation for this SCP would have been to demonstrate an improvement in maternal outcomes following the simulation training. Simulation offers a safe environment to

test evidence- based recommendations before fully implementing them into practice. This may offer a quicker avenue to bring recommendations from the literature into practice.

Concern for patient safety and improved outcomes are motivators to implementing the use of simulation. Reduced exposure to emergencies coupled with the increased complexities of patient care has necessitated the utilization of simulated learning experiences. This SCP does provide support for the use of simulation education to develop SA for critical experiences in the real world.

Conclusion

The needs of patients and advancement in medical care are changing so quickly that educators must think of alternative models of content delivery. This researcher is hopeful that the dissemination of this study's process and results motivate an increase in the use of simulation throughout the healthcare setting. Additionally, that healthcare education will integrate simulation to advance their provider's confidence and knowledge levels and clinical decision making abilities in critical care situations.

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Appendix A
Original Research Table

Study and Origin	Purpose of the study	Sample	Research Design	Intervention	Comparison	Outcome Measures/ Scales	Results
Bambini, D., Washburn, J., & Perkins, R. (2009) (USA)	Effect of simulation on self-efficacy of nursing students	112 convenient sample of baccalaureate nursing students Mean age: 24.85 Power analysis: 64 subjects	Mixed method	3 hour Simulated clinical experiences;	No control group	Self-efficacy and confidence levels; 10pt Likert Scale	Self-efficacy ($p<.01$). Increase in confidence in assessing vital signs ($p<.01$), breast ($p<.01$), the fundus (.001) and lochia ($P<.001$), and in providing patient education ($p<.001$). Three themes emerged: communication, confidence, and clinical judgment.
Birch *et al.* (2007) (USA)	Determine the most effective method of delivering training to staff on management of an obstetric emergency.	36 staff, junior and senior medical and midwifery, convenient sample, power analysis: 25 groups	Quasi-experimental: controlled before and after study and 3 months after study with qualitative interviews 1 year after study.	Full day of simulation, half day combination of simulation and didactic, or full day didactic	No control group	Knowledge (89 question-MCQ) and performance and confidence (Likert);	All teams improved in their performance and knowledge. Simulation only group sustained improvement in clinical management of the case, confidence, and knowledge. Study did not have enough power to reach statistical significance ($t(17)= .077$; $p=.94$; $r=.02$). The simulation group reported enjoying the experience the most.

Appendix A
Original Research Table

Study and Origin	Purpose of the study	Sample	Research Design	Intervention	Comparison	Outcome Measures/ Scales	Results
Cioffi, J., Purcal, P., & Arundell, F. (2005) (Australia)	Investigate the effects of a simulation strategy on the clinical decision making of midwifery students.	36 students upon entry into a graduate midwifery course; random sample; No power analysis	Randomized control study	Normal labor simulation and physiological jaundice simulation; no length of time mentioned	Scheduled lectures	Clinical decision making and confidence level; verbal protocol	The mean number of segments in the verbal protocols was 52(SD=19) for the experimental group, compared to 59(SD=14) for the control group, with an effect size of 0.4. Mean self-reported confidence levels for were higher for the simulation group (70%-80%) compared to the control group (50%-60%).
Cooper *et al.*(2010) (Australia)	Effect of simulation on students' ability to assess, identify and respond to patients either deteriorating or at risk of deterioration	51 final year, final semester student nurses; age ranges were from 20 – 54 years and 94.1% were women; convenience sample; power analysis: 100 students	Mixed methods design: before and after study plus a time-series study	Two seven-minute simulations	No control group	Knowledge (11 item MCQ) and performance and situational awareness (17 question stop-time test)	The mean knowledge score was 74% and the mean skill performance across both scenarios was 60%. Skill performance improved significantly (p>.01) by the second scenario. The mean situational awareness score across both scenarios was 59%.

Appendix A
Original Research Table

Study and Origin	Purpose of the study	Sample	Research Design	Intervention	Comparison	Outcome Measures/ Scales	Results
Crofts *et al.* (2007) (UK)	To explore the effect of simulation on knowledge and to assess knowledge is influenced by the training setting or teamwork training.	140, doctors and midwives, convenient sample; power analysis: 36 groups	Observational Design: before and after study	1 or 2 days of simulation training in a center or hospital	No control group	Knowledge (240 question MCQ – adapted)	There was a significant increase in knowledge following training; mean MCQ score increased by 20.6 points (95% CI, $p<0.001$). There was no significant effect on the MCQ score of either the location of training
Daniels *et al.* (2010) (USA)	Determine effect of simulation on crisis management skills	27 labor and delivery nurses, >1 year and <5 years of experience and obstetric residents from two institutions; random sample; No power analysis given.	Randomized controlled study	3 hours of simulation	1.5 hours of classroom lecture, followed by a 26 minute video tape, and a 0.5 hour of "hands on" demonstration and practice	Clinical decision making (20 question MCQ) and performance (3 item Likert scale)	There was overall improvement in the questionnaire scores but not statistically significant p= 0.06. Simulation trained groups scored significantly higher than the didactic trained group in both topic areas p= 0.002 and p= 0.032.

Appendix A
Original Research Table

Study and Origin	Purpose of the study	Sample	Research Design	Intervention	Comparison	Outcome Measures/ Scales	Results
Deering *et al.* (2009) (USA)	Create a simulation and validate a standardized grading form to evaluate competency in the management of PPH.	40 residents from 3 institutions; convenient sample; no power analysis	Observational design: post-test study only	5 minute simulation	No control group	Performance (10 point Likert scale) Objective/ subjective grading forms: Chronbach alpha	45% of the residents were able to correct the hemorrhage within the 5-minute time frame. Grading sheets were valid had good inter-rater reliability (0.92)
Limoges, J. (2009) (Canada)	Explore the written and communicate practices that form simulated learning.	9 faculty, 5 BSN students, and 4 PN students; convenient sample	Ethnography study	Simulation exposure, encouraged to take as much time as the student's needed	No control group	Confidence, anxiety (interviews and literature search)	Analysis was divided into six processes to illustrate the organization and knowledge production in the simulation lab:
Vadnais *et al.* (2011), (USA)	Determine effectiveness of simulation in management of critical obstetric events.	63 medical staff and residents, convenience sample; no power analysis	Observation design; before and after study; plus 4 month and 12 month posttest and 12 month simulation.	60-90 minute simulation plus 1 hour didactic	No control group	Knowledge (35 item MCQ) and self-confidence (10 point Likert)	Overall MCQ scores improved significantly ($P<0.005$) Overall Likert scores improved significantly ($P<0.01$)

Appendix B Systematic Reviews					
Authors/ Year	**Aim/ Question**	**Systematic Review Methods**	**Study Selection/ Methodological quality**	**Study Samples**	**Findings**
Cant, R. P & Cooper, S. J. (2009)	Evidence for using simulation in nursing in comparison to other educational strategies	Quantitative studies; 1999-2009; databases, reference lists, websites form nursing organizations; search terms: "simulation" and "human simulation"	Filtered non-nursing sample, virtual reality, standardized patients, and any studies that were not experimental or quasi-experimental	2019 references located; 12 studies retained	Statistical improvements in knowledge/skill, critical thinking ability and/ or confidence. Not enough consistency to compile results into a meta- analysis.
Cook et al. (2011)	Outcomes of simulation training for health professionals compared to no intervention	Any study; no beginning date – 2011; databases, reference lists; search terms: related to intervention, topic, and learners	Filtered studies that were not original research, did not use technology-enhanced simulation or health profession learners, did not offer a comparison, insufficient effect size, and or relevant outcomes	10,903 references located; 609 eligible studies	Consistency associated with large effects for outcomes, results compiled into a meta-analysis: knowledge (118 studies- pooled effect size 1.20; 95% CI, 1.04-1.35, P< .001), skills (426 studies – pooled effect size of 1.09; 95% CI, 1.03-1.16, p<.001), and learner behaviors (50 studies- pooled effect size 0.81; 95% CI, 0.66-0.96, p<.001), and moderate effects for patient-related outcomes (32 studies- pooled effect size 0.50; 95% CI, 0.34-0.66, p<.001).

Appendix B Systematic Reviews					
Authors/ Year	**Aim/ Question**	**Systematic Review Methods**	**Study Selection/ Methodological quality**	**Study Samples**	**Findings**
Harder, N. B. (2010)	Effectiveness of simulation as an effective teaching tool	Studies that measured performance or outcomes; 2003-2007; databases; search terms: simulat*, high-fidelity, clinical, teaching and learning, evaluat*, and educat*	Studies excluded were those published before 2003, descriptive in nature, and pertained to low or medium fidelity simulations	61 references located; 23 studies retained	20 studies indicated an increase in assessment and clinical skills performance, 21 studies reported students with higher confidence and perceived competence levels. Not enough consistency to compile results into a meta-analysis
Laschinger et al. (2008)	Effectiveness of using simulation in pre-licensure health professional education	Experimental, quasi, non-RCT, and before and after studies; 1995-2006; databases; search terms: “education/ learning”, “manikins/ simulation”	Two reviewers utilized the Joanna Briggs Institute System: experimental studies with a score >4 of 11 and observational studies with a score of >2 of 5 were included	1118 references located; 23 studies retained	Mixed data on whether knowledge levels, confidence levels, and skill performance were increased, all demonstrated higher learner satisfaction scores. Not enough consistency to compile results into a meta-analysis

Appendix C
Ranking the Level and Quality of Evidence

Study	**Research Design**	**Level of Evidence ***	**Quality of Evidence ****
Current Original Research			
Bambini, D., Washburn, J., & Perkins, R. (2009)	Mixed method	3	E3
Birch *et al.* (2007)	Quasi-experimental: controlled before and after study and 3 months after study with qualitative interviews 1 year after study.	3	E3
Cioffi, J., Purcal, P., & Arundell, F. (2005)	Randomized control study	1	E3
Cooper *et al.*(2010)	Mixed methods design: before and after study plus a time-series study	6	E3
Crofts *et al.* (2007)	Observational Design: before and after study	6	E3
Daniels *et al.* (2010)	Randomized Controlled study	1	E3
Deering *et al.* (2009)	Observational design: post-test study only	6	E3
Limoges, J. (2009)	Ethnography study	6	E3
Vadnais *et al.* (2011)	Observational design; before and after study; plus 4 month and 12 month posttest and 12 month simulation.	6	E3
National Guidelines			
National Collaborating Center for Women's and Children's Health (2004) Cesarean Section.	Systematic review of RCTs and original RCTs, with or without meta-analysis.	2	E1
Royal College of Obstetrics and Gynecologists (2009) Prevention and Management of Postpartum Hemorrhage.	Systematic review of RCTs and original RCTs, with or without meta-analysis.	2	E1
Waxman, K.T (2010) Clinical Simulation Scenario Guidelines	Systematic Review of descriptive and qualitative studies; expert opinion from BASC	5	E4

Appendix C **Ranking the Level and Quality of Evidence**			
Study	**Research Design**	**Level of Evidence ***	**Quality of Evidence ****
Systematic Reviews			
Cant, R. P. & Cooper, S. J. (2009)	Systematic review of 11 primary and secondary quantitative experimental studies: one research report	2	F2
Cook *et al*. (2011)	Systematic review of 609 studies: 137 RCT, 67 non-RCT, 405 before and after design	2	F2
Harder, B. N. (2010)	Systematic review of 23 quantitative and comparative research studies	4	F2
Laschinger *et al*. (2008)	Systematic review of 23 studies including randomized pre-posttest, quasi-experimental time series, non-randomized pre-posttest and exploratory descriptive studies.	2	F2

* Ackley, B., Ladwig, G., Swan,. B.A., & Tucker, S. (2008). *A clinical guide to evidence-based practice in nursing: Medical-surgical interventions.*

** Joanna Briggs Institute Levels of Evidence

Appendix D
Pre-Assessment Questions
The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses

Please write the number that you picked to identify your work for this simulation day so that we may keep your answers to this survey anonymous.

_____

In order to assess your confidence and knowledge related to obstetrics nursing care, before and after the simulation experience, please answer the following questions below.

For questions 1 through 6, rate your response to the statement, "I have…"

1. Confidence in recognizing the signs and symptoms of postpartum hemorrhage.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

2. Confidence in knowing how to respond to the early signs of postpartum hemorrhage.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

3. Confidence in knowing when to call for an additional nurse for help.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

4. Confidence in handling unfamiliar situations in which a patient appears to be manifesting symptoms from an emergent condition.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

5. Confidence in applying the patient care protocol for a patient experiencing signs and symptoms of postpartum hemorrhage.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

6. Confidence in differentiating a contracted uterus from a non-contracted uterus.
   a. Strongly agree
   b. Agree
   c. Neutral
   d. Disagree
   e. Strongly disagree

For questions 7-14, please choose one answer.

7. A nurse caring for a postpartum mother understands that which of the following findings are the earliest indication of hypovolemia caused by hemorrhage?
   a. Increased pulse and decreased blood pressure *
   b. Dizziness and increased respiratory rate
   c. Cool, clammy skin, pale mucous membranes
   d. Altered mental status and level of consciousness

8. During a postpartum assessment, the nurse finds a large amount of rubra lochia on the mother's perineal pad. The fundus is midline and firm at the umbilicus. Which of the following actions should be taken?
   a. Document the findings and continue to monitor the mother *
   b. Notify the provider
   c. Massage the mother's fundus frequently to contract the uterus
   d. Administer Pitocin 10 units IM once

9. The nurse is assessing a postpartum mother who was prescribed methlergonovine (Methergine). The nurse knows that the medication was effective when the mother has:
   a. A firm fundus *
   b. A rise in blood pressure
   c. An increase in lochia
   d. A decrease in breast discomfort

10. Maternal blood loss is usually:
    a. Underestimated
    b. Accurately assessed
    c. Overestimated
    d. Inaccurately assessed *

11. The most common cause of maternal intrapartum death is:
    a. Preterm labor
    b. Hemorrhage *
    c. Embolism
    d. Hypertension

12. Pitocin can be administered
    a. IV push
    b. Rectally
    c. Sublingually
    d. Titrated infusion *

13. The most common cause of postpartum hemorrhage is
    a. Vaginal laceration
    b. Uterine atony *
    c. Retained placental tissue
    d. Perinea hematoma

14. Hemabate may cause which of the following side effects?
    a. Nausea
    b. Vomiting
    c. Diarrhea
    d. All of the above *

Appendix E
Post – Assessment Questions
The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses

Please write the number that you picked to identify your work for this simulation day so that we may keep your answers to this survey anonymous.

_____

In order to assess your confidence and knowledge related to obstetrics nursing care, before and after the simulation experience, please answer the following questions below.

For questions 1 through 6, rate your response to the statement, "I have…"

1. Confidence in recognizing the signs and symptoms of postpartum hemorrhage.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

2. Confidence in knowing how to respond to the early signs of postpartum hemorrhage.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

3. Confidence in knowing when to call for an additional nurse for help.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

4. Confidence in handling unfamiliar situations in which a patient appears to be manifesting symptoms from an emergent condition.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

5. Confidence in applying the patient care protocol for a patient experiencing signs and symptoms of postpartum hemorrhage.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

6. Confidence in differentiating a contracted uterus from a non-contracted uterus.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

For questions 7-14, please choose one answer.

7. A nurse caring for a postpartum mother understands that which of the following findings are the earliest indication of hypovolemia caused by hemorrhage?
    a. Increased pulse and decreased blood pressure *
    b. Dizziness and increased respiratory rate
    c. Cool, clammy skin, pale mucous membranes
    d. Altered mental status and level of consciousness

8. During a postpartum assessment, the nurse finds a large amount of rubra lochia on the mother's perineal pad. The fundus is midline and firm at the umbilicus. Which of the following actions should be taken?
    a. Document the findings and continue to monitor the mother *
    b. Notify the provider
    c. Massage the mother's fundus frequently to contract the uterus
    d. Administer Pitocin 10 units IM once

9. The nurse is assessing a postpartum mother who was prescribed methlergonovine (Methergine). The nurse knows that the medication was effective when the mother has:
    a. A firm fundus *
    b. A rise in blood pressure
    c. An increase in lochia
    d. A decrease in breast discomfort

10. Maternal blood loss is usually:
    a. Underestimated
    b. Accurately assessed
    c. Overestimated
    d. Inaccurately assessed *

11. The most common cause of maternal intrapartum death is:
    a. Preterm labor
    b. Hemorrhage *
    c. Embolism
    d. Hypertension

12. Pitocin can be administered
    a. IV push
    b. Rectally
    c. Sublingually
    d. Titrated infusion *

13. The most common cause of postpartum hemorrhage is
    a. Vaginal laceration
    b. Uterine atony *
    c. Retained placental tissue
    d. Perinea hematoma

14. Hemabate may cause which of the following side effects?
    a. Nausea
    b. Vomiting
    c. Diarrhea
    d. All of the above *

For questions 15- 19, please refer to the simulation scenario that you just participated in.

15. What was the main change in vital signs at the beginning of the simulation?
    a. Pulse increased *
    b. Blood Pressure decreased
    c. Temperature increased
    d. Oxygen saturation decreased

16. What was the initial complaint that the patient verbalized that alerted you to a potential problem?
    a. "My peri pad feels wet."
    b. "I feel upset to my stomach." *
    c. "My breasts feel very full and achy."
    d. "I feel like my heart is beating really hard."

17. What was the most likely cause of your patient's emergency?
    a. Hypervolemia due to blood loss
    b. Uterine atony *
    c. Pulmonary embolism
    d. Cesarean section

18. What resource did you access first when you realized the patient's emergent condition?
    a. A nurse anesthetist
    b. The postpartum hemorrhage kit
    c. A second nurse
    d. The postpartum protocol *

19. How will your patient's condition change in the next fifteen minutes due to your use of the available resources? *Please select all that apply.*
    a. Her vitals will stabilize. *
    b. Her bleeding will slow down. *
    c. Her fundus will be midline and firm. *
    d. She will return to surgery for a hysterectomy.
    e. She will be restricted from breast feeding until Hemabate and Oxytocin wear off.

Please offer comments regarding the simulation education day that you were a part of today:

What was the most valuable aspect of the simulation education day?

What was the least valuable aspect of the simulation education day?

What is your opinion on the use of the simulator in nursing education?

Was the discussion that followed the simulation collegial and supportive?

Do you have any recommendations for future nursing training with simulation?

Appendix F
Critical Benchmarks in Simulation

Participant Number _____

Was the nurse able to recognize the early signs (within first 5 minutes) of post-partum hemorrhage in the simulated scenario?

☐ **YES** ☐ **NO**

If "NO," Was the nurse able to recognize the signs (within 5 – 10 minutes) of post-partum hemorrhage in the simulated scenario?

☐ **YES** ☐ **NO**

If "NO," Was the nurse able to recognize the late signs (within 10 – 15 minutes) of post-partum hemorrhage in the simulated scenario?

☐ **YES** ☐ **NO**

Appendix G
Costs of System Change Project

Key Persons/ Item	**Estimated Time/ Number**	**Quantity**	**Estimated Costs**
Viterbo Costs for Overall Build			**$270,000.00**
Manikin[1]	$22,000.00	4	$88,000.00
Laboratories[3]	$25,000.00	4	$100,000.00
Supplies/ Equipment[5]	$2,000.00	4	$8,000.00
Technology for hardware[5]	$550.00	4	$2,200.00
Consultant for educator training[5]	$2000.00	1	$2,000.00
Simulation Coordinator Time[5]	$65,000.00	Salary	$65,000.00
Work-study student[5]	$7.50 hourly	20 h x 32w	$4,800.00
Simulation Center not in use[5]	**20% of total cost**		**$67,500.00**
Viterbo costs for simulation project			**$0.00**
Hospital Costs for Simulation Education			**$8616.00**
Principal Investigator	$50.00 hourly	88 hours	$4,400.00 *
Rental of Simulation Center[5]	$75.00 hourly	8 hours	$600.00
Moulage for manikin[5]	$55.00	1	$55.00
Wages for 10 novice nurses[4]	$24.00 hourly	2.5 hours	$600.00
Wages for 3 backfill nurses[4]	$30.00 hourly	2.5 hours	$225.00
Wages for 3 obstetric educators[4]	$34.00 hourly	8 hours	$816.00
Simulation Coordinator time[5]	$50.00 hourly	36 hours	$1,800.00
Work study student time[5]	$7.50 hourly	16 hours	$120.00
Props for simulation - From unit	No charge		$0.00

* Denotes that this cost was not paid by the hospital for this project but would be projected for future projects.

Appendix H
Benefits of System Change Project

Key Items	**Estimated Time/ Number**		**Estimated Benefit**
Viterbo			
Financial support for hosting education[5]	1		$2,575.00
Rental of Simulation Center	*$75.00 hourly*	*8 hours*	*$600.00*
Moulage for manikin	*$55.00*	*1*	*$55.00*
Simulation Coordinator time	*$50.00 hourly*	*36 hours*	*$1,800.00*
Work study student time	*$7.50 hourly*	*16 hours*	*$120.00*
Full Utilization of Center	No unused time		$67,500.00
Hospital Costs Avoided for Hospital Education			**$28,600.00**
Hospital room occupied for training[2]	$1800.00 daily	1 day	$1,800.00
Risk of Poor patient outcomes[2]			$26,800.00
Surgery	1	*$10,000.00*	
Intensive care	1	*$15,000.00*	
Another day of stay	1	*$1800.00*	
Return on Investment for Hospital	**[($28,600.00 - $8,616.00)/ $8,616.00] * 100**		**232%**
Community			
Collaboration of two facility's resources			
Collaboration of area nurse educators			

[1]Durham and Alden (2008, April).
[2]Healthcare Blue Book (2012).

[3]Rothgeb (2008).
[4]R. Genz RN, MSN, personal communication, May 2012.
[5]C. Wilson RN, MSN, personal communication, September 2012.

Appendix I
The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses
Statement of Consent

You are invited to participate in a survey, of which constitutes my study, investigating whether simulation education compared to other forms of education affect a novice nurse's situational awareness in an obstetrical emergency.

If you consent and understand the terms of your commitment to this study, please fill out the pre-assessment survey assessing your confidence and knowledge level in managing an obstetric emergency.

This survey will remain anonymous. After the survey is complete you will participate in the 20 minute mandatory simulation and you will fill out another survey after the simulation and debriefing sessions.

Participation in this research study is voluntary. Your decision whether or not to participate will not affect your future relations with Mayo Clinic Health System – Franciscan Healthcare La Crosse in any way. If you decide to participate, you are free to stop at any time without affecting these relationships.

APPENDIX J

ST. CATHERINE UNIVERSITY

April 16, 2012

Kristin Schams MSN, RN, CNE
900 Viterbo Drive,
La Crosse, WI, 54601

Re: IRB#12-N-26: The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses

Dear Ms Schams:
Thank you for submitting your research proposal to the St. Catherine University Institutional Review Board (IRB). The primary purpose of the IRB is to safeguard and respect the rights and welfare of human subjects in scientific research. In addition, IRB review serves to promote quality research and to protect the researcher, the advisor, and the university.
On behalf of the IRB, I am responding to your request for Exempt level approval to use human subjects in your research. Two members of the St. Kate's IRB have reviewed your application. As a result, the project is approved as submitted.

If you have any questions, feel free to contact me by phone (X 6951) or email (jdfleming@stkate.edu). Also, please note that all research projects are subject to continuing review and approval. You must notify our IRB of any research changes that will affect the risk to your subjects. You should not initiate these changes until you receive written IRB approval. Also, you should report any adverse events to the IRB. **Please use the reference number listed above in any contact with the IRB.** This approval is effective for one year from this date. If the research will continue beyond one year, you must submit a request for IRB renewal. When the project is complete, please submit a project completion form. We appreciate your attention to the appropriate treatment of research subjects. Thank you for working cooperatively with the IRB; best wishes in your research!

Sincerely,
John D. Fleming, EdD, OTR/L
Acting Chair, Institutional Review Board
Cc: Matt Byrne

APPENDIX K

IRB

Institutional Review Board Viterbo University

DECISION FORM

Principal Investigator: Kristin Schams

Title of Project: The Impact of high Fidelity Stimulation on Situational Awareness of Cardiac Related obstetric Emergencies in Novice nurses

Decision:

☒ Approved as submitted

☐ Conditionally approved pending submission of the following revisions:

Revisions approved: _____ _____
Signature of IRB Chair Date

☐ Denied for the following reason:

Exempt Review: Anna Sandra-Borelli 4/27/12
Signature of IRB Chair or Designated Representative Date

Expedited Review: _____ _____
Signature of IRB Committee Member Date

_____ _____
Signature of IRB Committee Member Date

Full Review: _____ _____
Signature of IRB Chair Date

REMINDER: Researchers may not implement any changes to the approved protocol without prior approval from the IRB.

APPENDIX L

MAYO CLINIC
HEALTH SYSTEM

Franciscan Healthcare-La Crosse
700 West Avenue, South
La Crosse, WI 54601

May 2, 2012

Kristin Schams MSN, RN, CNE
St. Catherine's University
900 Viterbo Drive
La Crosse, WI, 54601

Dear Ms. Schams:

Thank you for submitting the proposal (including appendices) for the following study:

> The Impact of High Fidelity Simulation on Situational Awareness of Cardiac Related Obstetric Emergencies in Novice Nurses

After reviewing the proposal and applying the Mayo IRB decision algorithm to determine the appropriate level of review, I noted that the study involves surveys of nursing staff and does not include the use of any personally identifiable data. As such, it does not does not require IRB review, in accordance with the Code of Federal Regulations, 45 CFR 46. Therefore, continuing or annual IRB review of this protocol is not required as currently written. **If at any time there are modifications to the study design or procedures, they should be submitted to the IRB to for re-review.**

If I can be of further help to you, please feel free to contact me. I look forward to hearing the results of your survey. Best of luck!

Sincerely,

Thomas J. Grau, M.D.
Chairman, IRB

TG/kjh