Impact of a Trauma Boot Camp on Nurse Knowledge, Skills and Confidence, and Frequency of Unplanned Intensive Care Admissions

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Abstract

Background: As an integral part of the trauma team, nurses provide skilled assessments, critical thinking, and effective communication (Peters et al., 2018). Trauma patients are complex, which requires appropriate education for nurses to meet their needs, yet there is little research on trauma-focused nursing education for inpatient nurses (Garvey et al., 2016). This study explores the impact of a trauma boot camp on nurse trauma knowledge, confidence, and skills and on the frequency of unplanned intensive care (UICU) admissions in trauma patients.

Methods: A quasi-experimental one group study with pre- and post-intervention repeated measures design was used. The convenience sample included nurses employed with < 3 years nursing experience practicing on inpatient surgical units at a Level I Trauma Center. Knowledge and confidence were measured pre- and immediately post-boot camp, and 30, 60, and 90 days later. Skills were measured the day of the boot camp. Unplanned ICU admission data was compared 90 days pre- and post-intervention.

Results: Of the 20 nurses who attended the boot camp, only four participated in the study knowledge, confidence, and demographic data measures. Self-confidence levels from the simulation laboratory course evaluation tool demonstrated significant improvement for all participants in ability to recognize a deteriorating trauma patient ($p = 0.0001$), ability to perform assessments on a deteriorating trauma patient ($p = 0.0002$), ability to intervene appropriately for a deteriorating trauma patient ($p = 0.0003$), and ability to describe use of the facility bladder management protocol and for spinal cord injury patients ($p = 0.0001$). Skill level had no improvement from the first to final simulation; however, five of the seven simulation groups had an increase in their scores ($p \geq 0.05$). Unplanned ICU admissions significantly increased from pre- to post-boot camp ($p \leq 0.05$).

Conclusions: A trauma boot camp incorporating simulation-based training followed by debrief and then lecture may improve confidence levels in inpatient trauma nurses with < 3 years of practice experience. Further research is needed to determine the effects on retention of knowledge, skill, and patient outcomes related to UICU admissions.

Key words: trauma boot camp, simulation-based training, knowledge, skills, confidence, unplanned ICU admissions

Dedication

This work is dedicated to my parents for their unwavering support in all my pursuits, their constant guidance, for always letting me know I can do or be anything I want if I work for it and loving me unconditionally. Without them, I would not be where I am today.

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Chapter One. Introduction

Trauma continues to be a public health problem that impacts healthcare systems (Haley et al., 2017). Trauma patients often have missed or delayed injuries and tend to have higher rates of instability or polytrauma (Tammelin et al., 2016). These factors put trauma patients at high risk for sudden decline requiring unplanned admission to intensive care and higher morbidity and mortality (Frank et al., 2020; Tammelin et al., 2016). As an integral part of the trauma team, nurses provide skilled assessments, critical thinking, and effective communication (Peters et al., 2018). Since nurses are with the patient around the clock, they are vital in recognizing patient deterioration and preventing "failure to rescue" (FTR), a nurse-sensitive indicator (Mushta et al., 2017).

Trauma centers designated through the Commonwealth of Virginia must provide four hours of trauma-specific education annually to all nurses caring for trauma patients (Virginia Department of Health, 2015). Several nationally prepared courses on trauma exist, such as the Emergency Nurse's Association's Trauma Nurse Core Course, but the target audience for these courses is emergency nurses (Ding et al., 2016; Haley et al., 2017). The Society of Trauma Nurses (STN) Advanced Trauma Care for Nurses (ATCN) Course targets all trauma nurses. However, the course focuses primarily on the resuscitation phase immediately following traumatic injury, with little focus on ongoing trauma care (Society of Trauma Nurses, 2020). Trauma Care After Resuscitation (TCAR) is a 2-day course focused on care after resuscitation in the trauma bay. All the courses provided by professional organizations require payment, which is a barrier for most facilities (G. Witt, personal communication, May 27, 2021).

A study in England observed that ATCN outcomes for knowledge retention were poor at 3 months post-course completion (Ding et al., 2016). The STN also offers an e-library on multiple trauma topics that is a read-only version and does not include a method to assess knowledge retention (B. Dooley, personal communication, June 30, 2021). Only one study looked at knowledge retention for ATCN (Ding et al., 2016). TCAR does have participants complete a 25-question pre-course and a 50-question post-course final assessment; however, they do not require a passing grade to complete the course (Trauma Care After Resuscitation, 2021). Trauma patients are complex, which requires appropriate education for nurses to meet patient needs, yet there is little research on trauma-focused nursing education for inpatient nurses (Garvey et al., 2016). This study aimed to determine if a trauma boot camp improves knowledge retention, skills, and confidence in nurses caring for trauma patients and reduces trauma UICU admissions.

Problem and Significance

The Institute of Medicine's Committee on the Adequacy of Nurse Staffing in Hospitals and Nursing Homes stated, "Nursing is a critical factor in determining the quality of care in hospitals and the nature of patient outcomes" (Institute of Medicine, 1996, p. 92). Patients with emergency admissions, such as trauma patients, are at higher risk for UICU or upgrades, increasing their mortality (Frost et al., 2009). Patients that suffer an UICU upgrade have higher mortality rates and are considered "clinically significant events" (Mulvey et al., 2019, p. 14). In trauma patients, the most common causes of an UICU admission are respiratory or cardiac decline, older age, and major surgeries during the current admission (Mulvey et al., 2019). Rubano et al.'s (2016) study found that 28.1% of all ICU admissions were an UICU admission with pneumonia being the most common cause for the upgrade to ICU. There is little research on

improving trauma nurses' knowledge, skills, and confidence or how it impacts UICU admissions. More research is needed to determine the effect of SBT on trauma nurses' knowledge, skills, and confidence and how that affects UICU admissions.

The study setting was in southwest Virginia, at a Level I Trauma Center that provides trauma services for the Roanoke region, covering a 150-mile catchment area. Trauma patients not requiring ICU admission after the intensive management in the trauma bay go to one of the surgical progressive care units or the medical surgical (Med/Surg) floor. For the last 2 years, the project facility has observed increased admissions or upgrades to the intensive care unit (ICU) among trauma patients on these units due to missed respiratory or neurological decline (P. Boremski, personal communication, April 2, 2020). One of the potential causes could be the high turnover of nurse staffing in those units. The study units have suffered unusually high nurse turnover rates of 58% between two units over the past 18 months (R. Dingus, personal communication, March 1, 2021, B. Hickman, personal communication, March 1, 2021). High turnover of nursing staff, coupled with the ever-changing healthcare environment, makes it difficult for nurses to maintain competencies in trauma patient care (Ding et al., 2016; Haley et al., 2017). Since nurses play a significant role in the quality of care, there is a potential for poor patient outcomes with nursing turnover.

Another potential cause of increased unplanned UICU admissions could be gaps in knowledge of the trauma nurses in inpatient surgical units or an inadequate trauma education program. The remaining nurses on both units have an average of 2 years of experience (R. Dingus, personal communication, March 1, 2021; B. Hickman, personal communication, March 1, 2021). Trauma nurse courses developed in the study setting by the trauma service and the emergency department's educators focus only on the resuscitation phase of trauma care in the

trauma bay. Currently, there are no structured orientation courses for inpatient nurses on trauma patient care at this facility or from nursing professional organizations. The American Association of Critical Care Nurses (AACN) online Essentials of Critical Care Orientation (ECCO) is used to orient new nurses in the project setting (B. Dooley, personal communication, March 20, 2020). The AACN course incorporates trauma topics within specific modules and does not separate trauma as a module on its own. Therefore, it is difficult to determine if nurses are getting adequate knowledge and skills from the education for trauma care. Additionally, the pre- and post-test for the AACN course does not include questions related to trauma care (S. Blankenship, personal communication, June 30, 2021).

The project facility does provide some trauma education to staff, including the STN e-library, online courses related to care of the trauma patient, failure to rescue in-services, and TCAR. However, the STN library is not mandatory, TCAR is offered every other year with limited availability and has been on hold since COVID-19 started, and the staff provided trauma education is not recurrent or structured but in the form of in-services.

Purpose of the Project

This project aimed to determine if a trauma boot camp focused on post-resuscitation care improved the knowledge, skills, and confidence of post-resuscitation trauma care in inpatient progressive care trauma nurses. The course was developed using UICU admission data and the results of a needs assessment on nurses' self-identified and provider-identified gaps in nurse knowledge. The secondary purpose was to investigate whether the boot camp focused on post-resuscitation care reduced unplanned trauma ICU admissions. The project ultimately aimed to develop a structured educational course that helps all nurses prepare to care for trauma patients

in the inpatient setting. Another expectation was improved patient outcomes with proper nurse training, as evidenced by decreased UICU admissions.

Theoretical Framework

The conceptual framework used for this project was Kolb's experiential learning theory (Kolb, 1981). Kolb felt knowledge occurred through learning experiences and stated, "Learning is a continuous process, and knowledge is created by transforming experience into existing cognitive frameworks, thus changing how a person thinks and behaves" (Lisko & O'Dell, 2010, p. 106). Concepts in Kolb's experiential learning theory include comprehension, apprehension, and transformation (Lisko & O'Dell, 2010). Comprehension happens outside the event through abstract conceptualization after the educational session, working with practical applications, doing technical tasks, or after analyzing the simulation scenarios (Lisko & O'Dell, 2010). Operationalization of comprehension occurred in this project through participating in the simulations, debriefing after each simulation scenario, and through an evaluation where participants reflected on their confidence and satisfaction levels. Apprehension is when the learner takes part in the learning experience, such as a simulation with hands-on practice and learning through self-reflection and feedback on their performance during the debriefing process (Lisko & O'Dell, 2010). This project's operationalization of apprehension occurred when learners participated in simulation scenario-based training and completed the self-reflection on their performance. Transformation occurs when simulation knowledge is applied at the bedside (Lisko & O'Dell, 2010). Operationalization of transformation occurred through the effect on trauma UICU admission rates. The research team anticipated the students would apply what they learned to their bedside practice, leading to improved patient outcomes. Knowledge and skill retention can occur through repeated

practices when caring for similar patients or through repeated training. This study measured transformation through retention processes by knowledge, confidence, and skills evaluation tools immediately after completion of the boot camp and at 30-, 60-, and 90-day post-completion.

Kolb's theory discussed four different learning styles: accommodating, diverging, converging, and assimilating (Lisko & O'Dell, 2010). Hands-on activities such as simulation or skills labs are best for accommodating learners. Those that learn through self-reflection are diverging learners, as seen with apprehension. Learners that prefer comprehension, such as abstract thinking, are converging learners. The final learning style is assimilating; they learn by comprehension and apprehension. The learning methods used in this study were based on a prior needs assessment that surveyed trauma nurses, including those practicing in the proposed study units, on which learning methods they preferred. The survey included several learning methods addressing all four of Kolb's learning styles. The survey results assisted the author in determining the learning styles of potential course participants, so the training could incorporate methods to engage all learners.

Kolb's experiential learning theory discussed a four-stage learning process as well. The stages are concrete experience, reflective observation, abstract conceptualization, and active experimentation (Lisko & O'Dell, 2010). Online education or traditional lectures have limitations in providing experiential learning since they cannot offer a place where the learner can experiment safely, have hands-on experiences, or have opportunities for self-reflection (Garvey, 2016). Simulation scenario-based learning addresses all four stages of the learning process in Kolb's Theory: by creating an environment for openness and discussion, allowing time for reflection, opportunities for understanding the simulation scenario, and a place for

experimentation where the learner can provide care while not placing a patient at risk. Therefore, this study used the simulation scenario-based education coupled with a didactic lecture to train nurses taking the Trauma Boot Camp focused on post-resuscitation care and examined the effect of boot camp on knowledge retention, skill level, and confidence levels. The researcher developed simulation education and didactic lectures to provide learning experiences that apply to all four learning stages and the learning styles of comprehension, apprehension, and transformation.

PICOT Questions

In inpatient surgical nurses that care for trauma patients (Population), how does a trauma boot camp focused on post-resuscitation care (Intervention) impact nurses' knowledge, skill, and confidence levels in care of the trauma patient and unit-based unplanned trauma ICU admissions (Outcomes) when comparing pre- and immediately post-knowledge, skills and confidence levels, and knowledge and confidence levels (Comparison) at 30 days, 60 days, and 90 days post-intervention (Time)?

Research Question/Hypothesis

The study aimed to answer the following questions: 1) What effect does a trauma boot camp focused on post-resuscitation care have on the knowledge retention of nurses working in the inpatient surgical units? The null hypothesis is that a trauma boot camp focused on post-resuscitation care will not affect knowledge retention. The alternate hypothesis is that a trauma boot camp focused on post-resuscitation care will affect knowledge retention. 2) What effect does a trauma boot camp focused on post-resuscitation care have on the confidence levels of nurses working in the inpatient surgical units? The null hypothesis is that a trauma boot camp focused on post-resuscitation care will not affect the confidence levels of nurses working in the

inpatient surgical units. The alternate hypothesis is that a trauma boot camp focused on post-resuscitation care will affect the confidence levels of nurses working in the inpatient surgical units. 3) What effect does a trauma boot camp focused on post-resuscitation care have on the skill performance of nurses working in the inpatient surgical units? The null hypothesis is that a trauma boot camp focused on post-resuscitation care will not affect the skill performance of nurses working in the inpatient surgical units. The alternate hypothesis is that a trauma boot camp focused on post-resuscitation care will affect the skill performance of nurses working in the inpatient surgical units. 4) What effect does a trauma boot camp focused on a post-resuscitation care curriculum have on unit-based trauma unplanned ICU admissions? The null hypothesis is that a trauma boot camp focused on a post-resuscitation care curriculum will not affect unit-based trauma unplanned ICU admissions. The alternate hypothesis is that a trauma boot camp focused on a post-resuscitation care curriculum will affect unit-based trauma unplanned ICU admissions.

The author hypothesized that a trauma boot camp focused on post-resuscitation care would improve knowledge retention, skill levels, and confidence levels in nurses who attended the boot camp. A second hypothesis was that there would be a reduction in unit-based trauma UICU admissions from pre- to post-trauma boot camp focused on post-resuscitation care intervention.

Definition of Key Terms and Variables

Key terms included knowledge retention, skill level, confidence level, unplanned ICU trauma admissions, or upgrades to the intensive care unit. Knowledge retention was defined as improved test scores from pre- to post-test and maintaining post-test scores at 30, 60, and 90 days. Skill level was defined as improved skills checklist scores from the first to the last

simulation for a total of five simulation scenarios. The confidence level was defined as improved self-reported confidence using a 5-point Likert scale with objective-driven skills from pre- to post-course completion. One confidence evaluation tool was emailed pre-, post-0, 30, 60, and 90 days after completion of the boot camp. The objective-driven skills checklist was emailed pre- and post-boot camp only. A third confidence evaluation from the simulation lab was added to the study measures because of low response rates to the emailed study evaluation tools; it is also an objective-driven skills checklist. Unplanned admission to ICU is "patients admitted to the ICU after initial transfer to the floor and/or patients with an unplanned return to the ICU after an initial ICU discharge," as defined in the American College of Surgeons Trauma Quality Improvement Program National Trauma Data Bank. For example, a patient moved to the stepdown unit from the ICU but needed readmission to the ICU for respiratory distress.

The independent variable was the trauma boot camp focused on post-resuscitation care. The dependent variables were the knowledge evaluation tool scores, skills evaluation tool scores, confidence evaluation tool scores, and UICU admission rates. Other variables analyzed included gender, age, years as a nurse, years as a nurse on the unit, level of education, previous experience with trauma patients, previous trauma education, nursing certifications, age, Injury Severity Score, Trauma Revised Injury Severity Score, ICU length of stay, number of ICU visits, hospital length of stay (HLOS), number of ventilator days, intubated during UICU admit, reason for UICU, and discharge status.

Chapter Two. Literature Review

Simulation has gained popularity in nursing education as it provides a method to teach clinical skills without risk to the patient (Johnson et al., 2014). Traditional lecture formats focus more on memorization than critical thinking skills, so having other ways to teach nurses is necessary. Trauma patients are complex and require appropriate education for nurses to meet their needs, yet there was little research on trauma-focused nursing education for inpatient nurses (Garvey et al., 2016).

Search Strategies

Search engines used to explore the literature were CINAHL, PubMed, Cochrane, and Google scholar. Search terms included trauma, orientation, education, simulation, online, and knowledge retention. Article inclusion criteria included articles with full-text availability or were available through interlibrary loan, written in English or had English translations available, and were written in the past 7 years. Including a few articles older than 5 years was allowed due to the lack of more recent articles on specific topics, such as Kolb's theory.

Exclusion of articles occurred if there was no ability to obtain a full-text copy, a copy in English, or if the publication was older than 7 years, except for the articles previously mentioned. Some articles that met the inclusion criteria were excluded because they did not provide enough information or data on the areas focused on in this study.

Simulation-Based Training (SBT)

Simulation-based training was an effective teaching method that nurses found satisfying and is considered the gold standard in nursing education (Mariani & Doolen, 2016; Yu & Roh, 2017). When comparing lectures to simulations, lectures did not improve long-term knowledge retention better than high-fidelity simulations; however, it was comparable to simulations when

measuring immediate knowledge gained (Alluri et al., 2016). One study comparing didactic only to didactic with simulation found that neither instructional technique is superior to the other regarding knowledge retention (Bodine & Miller, 2017). This finding was surprising given the numerous studies that show SBT to be superior to the lecture-only format for knowledge retention. However, Alluri et al.'s (2016) study found no difference in immediate knowledge retention when comparing the two formats. Still, long-term knowledge retention only improved significantly in the SBT group. Incorporating several educational methods such as simulation, debriefs, skills labs, and lectures improve confidence, skills, and knowledge (Abe et al., 2013; Garvey, 2016). This finding is why the researcher used simulations, debriefs, and lectures for the study.

The type of mannequin or level of fidelity is just as important as the educational method in SBT (La Cerra et al., 2019). Compared to mannequin-based methods, a web-based patient design did not improve knowledge and skills as much as the mannequin group (Johnson et al., 2014). While all participants showed significant improvement on the performance checklists and self-reported knowledge, the mannequin group scored significantly higher in self-assessed practice and post-training performance checklists when compared to the web-based patient group (Johnson et al., 2014). When comparing the virtual patient format to the mannequin-based design, the mannequin improved post-test scores better than the virtual method (Liaw et al., 2014). Using high-fidelity patient simulators in simulation-based training had a significantly higher impact on knowledge and performance when compared to low-fidelity mannequins and standardized patients (La Cerra et al., 2019). The type of simulation mannequin used for scenarios affects knowledge and performance as high-fidelity patient simulators have a significantly higher impact on knowledge and performance when compared to low-fidelity

mannequins and standardized patients (La Cerra et al., 2019). There was no difference between simulators or standardized patients for participants' satisfaction, self-confidence, and self-efficacy levels (La Cerra et al., 2019). La Cerra et al.'s (2019) findings support the researcher's decision to use a high-fidelity simulator as they have an enhanced impact on knowledge and performance.

Knowledge Retention and SBT

Simulation-based training has proven to have a statistically significant effect on knowledge retention (Jyoti et al., 2021; Kahraman et al., 2019; Karatas & Tuzer, 2019; Kim & Shin, 2016; Said et al., 2021). Said et al.'s (2021) quasi-experimental study looked at 40 nurses in an obstetrics and gynecology department in Egypt. The study aimed to determine the effect of simulation on knowledge, practice, and self-efficacy during the management of eclamptic fits. The knowledge test was 17 questions and included multiple-choice and open-ended questions. The simulation group had statistically significantly higher test scores than the control group, demonstrating that SBT positively impacts knowledge retention (Said et al., 2021). When comparing lectures to SBT, lectures did not result in improved long-term knowledge retention compared to high-fidelity simulations; however, they were comparable to simulation when measuring immediate knowledge gain (Alluri et al., 2016). Simulation-based training has lasting effects on knowledge retention, as students reported continued knowledge retention several weeks after attending SBT (Hustad et al., 2019). Nurses perceive simulation improves knowledge and skills, confirms or corrects knowledge, skills, or actions and provides learning opportunities by watching their peers, reflects on what they did or saw through debriefing (Abelsson et al., 2018).

Students have found that simulations helped mentally prepare them for starting their clinical rotation because simulations bridged the gap from book learning to hands-on learning (Hustad et al., 2019). Students also shared that simulation training made them more aware of the importance of performing a patient assessment and reviewing vital signs. Bedside nurses have reported enjoying simulation experiences and their ability to synthesize new knowledge (Bodine & Miller, 2017; Hustad et al., 2019; Mariani & Doolen, 2016). Simulations were also more motivating for nurses, improving their participation rates and knowledge transfer to bedside practice (Hustad et al., 2019; Liaw et al., 2016). Prior studies support the researcher's decision to use SBT to improve knowledge retention in this study.

Skill Level and SBT

Simulation-based training has proven to improve nurses' skills (Hegland et al., 2017; Parikh et al., 2022). In a Texas study looking at 62 neonatal intensive care nurses and the quality of their chest compressions, simulations and debriefing were used as the educational method in the prospective observational study (Parikh et al., 2022). Chest compression depth and fraction significantly improved from pre-debrief to post-debrief, while chest compression rate and recoil had no difference. Simulation-based training positively impacts the skill levels of the learners participating in the activity (Jyoti et al., 2021; Kim & Shin, 2016). The repeated scenario simulation method improved clinical performance and nontechnical skills, such as teamwork (Abe et al., 2013; Abelsson et al., 2017). These findings support the researcher's decision to use repeated simulations for this study.

Confidence Level and SBT

Simulation improves teamwork and communication, increasing nurses' self-confidence and nurses found it satisfying (Harvey et al., 2019; Hsu et al., 2015; Hustad et al., 2019; Kim &

Shin, 2016; Rice et al., 2016). Simulation-based training studies have positively impacted nurses' self-confidence (Kahraman et al., 2019). Simulation-based training has also helped reduce anxiety, increasing confidence (Orsi et al., 2019). In the Parikh et al. (2022) study mentioned above, the NICU nurses demonstrated significantly higher confidence levels in all areas of chest compressions (rate, depth, fraction, and recoil) after the simulation and debriefing. Evidence shows simulation's positive impact on self-confidence, self-efficacy, and perceptions; however, continued research of these variables was recommended (Mariani & Doolen, 2016). These findings and recommendations support the researcher's decision to use SBT to improve confidence levels in this study.

Trauma Unplanned ICU Admissions and SBT

Learner outcomes improved when using medium- to high-fidelity simulations focused on recognizing patient decline, and the simulations lasted 40 minutes or less (Connell et al., 2016; Liaw et al., 2016). Simulations positively impact the learner, patients, and organizational outcomes. Trauma patients were more likely to experience a failure to rescue (FTR) early in their hospital stay, in the ICU, and suffer from a respiratory or cardiac complication. The patients had higher injury burdens, were older, and had suffered blunt trauma (Sharoky et al., 2019). Simulation impacted both knowledge and patient outcomes (Connell et al., 2016; Liaw et al., 2016). Several studies have shown that nurses' recognition of patient deterioration improved when using simulation as a teaching method (Connell et al., 2016; Kelsey & Claus, 2016; Liaw et al., 2016).

Gaps in the literature included simulation-based education for inpatient nurses' caring for trauma patients and how it impacts knowledge, skills, confidence, and UICU admissions. Only two articles specifically addressed simulation and trauma education in this study's format, which

supported the need for further research. Multiple education methods can help improve skill attainment, knowledge retention, and confidence. Only one article studied trauma-related education, yet the studies' basic premises helped inform this author's project. This author's Doctor of Nursing Practice project planned to use a repeated simulation format. The project's purpose was to determine if a trauma boot camp focused on post-resuscitation care improved the knowledge, skills, and confidence of post-resuscitation trauma care in inpatient surgical nurses. A secondary purpose was to investigate whether the boot camp focused on post-resuscitation care reduced unplanned trauma ICU admissions.

Chapter Three. Methodology

Study Design

A quasi-experimental one-group study with pre-/post-intervention repeated measures was used in this study.

Study Subjects

This study used convenience sampling because the study uses the "most conveniently available people as participants" (Polit & Beck, 2017, p. 252). The inclusion criteria included registered nurses (RN) hired within the past 3 years working in the inpatient surgical units, caring for trauma patients, and who attended the intervention trauma boot camp. Initially, the study was only for nurses from the two progressive care units. Additional nurses from the surgical Med/Surg unit were added to increase the sample pool due to the low number of available nurses. All RNs with less than 3 years of experience on the unit comprised potential study subjects. Exclusion criteria included RNs with more than 3 years of experience on the unit. At the time of study recruitment, 28 PCU and 11 surgical Med/Surg nurses comprised the study's potential subject pool (B. Dingus, personal communication, March 1, 2021; B. Hickman, personal communication, March 1, 2021). Since this was a pilot study, a power analysis was not needed.

Study Setting

The intervention occurred at the freestanding simulation lab affiliated with the researcher's facility in southwestern Virginia. The trauma department serves approximately 3,000 patients a year. The number of nurses on the units varies based on the level of care. Currently, there is no structured trauma education in the study setting for inpatient nurses using simulation and lecture combined.

Human Subjects Protection

The research team obtained approval from Radford University and the hospital Institutional Review Boards (IRB) before the implementation of the study. The IRB determined that the study was minimal risk and exempt from full IRB review. Written consent was waived due to the nature of the study. Trauma boot camp attendance was mandatory; only participation in the knowledge tests and confidence surveys was voluntary. Information about the research study was emailed to identified participants a week before the course and reviewed by the research team the day of the course (see Appendix B). There was a minimal risk for physical or psychological harm to the participants. Potential participants were informed in writing before participation that they would get no awards and no penalty applied to nurses who decided not to participate in the study. Participants were allowed to drop out of the study at any point during the study period without being penalized. Participants were informed in writing and in person on the day of class that the results of individual tests or surveys are anonymous and would not be used to penalize the participants. The participants were made aware, in writing and in person, on the day of class that the knowledge and confidence evaluation tools would be emailed via REDCap® by the Health Analytics Research Team (HART) team. Once they clicked on the link for REDCap®, they were assigned a random number that only the HART team would be able to access. The research team received data reports using the randomly assigned identification numbers from REDCap®.

Demographic data (see Appendix C), knowledge evaluation data (see Appendix D), and confidence evaluation data (Appendix E & F) were collected and stored using REDCap®, which automatically assigned each student an identification number. REDCap® is a secured, web-based data collection tool. The HART kept a master list of participants in REDCap®. This list ensured

that emails with the pre-, post-0, and 30-60-90-day post-evaluation tools went to those still working for the study units. The research team updated the HART team member when study participants were no longer working on the study units or for the organization to remove them from the study. Only the HART team accessed the REDCap® data. Any dataset used for analysis did not include identifiable human information, such as name, date of birth, and social security number.

The potential benefits of participation included participating in a new and innovative course, focused post-resuscitation education related to trauma patient care, and improving knowledge retention and patient outcomes. The anticipated risks of participation were minimal and included anxiety, discomfort, and stress-related to test-taking and participating in the simulations.

Phase One: Study Procedure

Identification of eligible subjects occurred through staff lists provided by the unit directors of the study units. The list included all RNs' names, the date of hire on the unit, and the date and time they were scheduled to attend the boot camp. The unit directors screened and determined RNs who met the study criteria. An email was sent to subjects informing them of the study purpose and details and inviting them to participate in this study (see Appendix B). Unit directors scheduled the participants to attend the boot camp on dates that worked best for the staff member's schedule. While the boot camp was mandatory as a part of nursing staff education, participation in the knowledge and confidence evaluations was not. Potential subjects were emailed information about the research study a week before the course on December 29, 2021, and the information sheet was reviewed by the researcher again on the day of the boot camp (see Appendix B). Potential subjects were also provided information when they logged into

REDCap® for every evaluation and survey (Appendix B), reminding them that participation was voluntary and that they could start or drop out of the study at any time.

Potential subjects were sent a link via REDCap® on December 29, 2021, a week before they attended the course with the demographic survey (see Appendix C), the knowledge (see Appendix D), and confidence evaluation tools (see Appendix E & F). Boot camps were held from January 5, 2022, through February 3, 2022, and the post-knowledge and confidence evaluation tools and course evaluation surveys were emailed to participants during that time. Emails with the 30-day knowledge and confidence evaluation tools were sent to participants from February 5, 2022, through March 7, 2022. The 60-day knowledge and confidence evaluation tools were sent to participants from March 8, 2022, through April 8, 2022. The final 90-day knowledge and confidence evaluation tools were sent to participants from April 9, 2022, through May 9, 2022. After participants completed the post-test at a 90-day follow-up, feedback on the test was provided to participants to enhance their learning via email. The email included the test questions with correct answers, the rationale for the right answer, and any relevant policies or protocols.

Confidence evaluation tools (see Appendix E and F) were used to evaluate the general confidence and the skill-specific confidence relevant to the topics covered after the simulation course. The confidence evaluation tools were emailed via REDCap® before the course and post-0. The NLN confidence evaluation tool was emailed via REDCap® at 30, 60, and 90 days after the boot camp to determine if confidence levels were maintained. In addition, due to low response rates to the study surveys, the simulation laboratory center's (sim lab) course evaluation tool was added to the study dataset after the boot camp was completed (see Appendix G). The sim lab evaluation included confidence level data that the participants filled out on paper

anonymously at the end of the day without the researcher present. The data from those evaluations were reported in aggregate to the researcher, per the sim center's procedure for courses taught in the sim lab. The researcher submitted an updated IRB application asking to use the data from the sim lab evaluations to have data to analyze due to the low response rates from REDCap® tests and surveys. The IRB approved the request, and the sim lab sent the raw data directly to the HART team for analysis.

The researcher developed five simulation scenarios with a simulation staff and a simulation expert, which were used for education and evaluation (see Appendix H). Simulation scenarios were developed covering the topics identified through a previous needs assessment and UICU admission data to address gaps in trauma patient care. In addition, when preparing the simulation course, the following items were discussed: triggers for the simulations requiring specific actions, needed supplies, moulaging of manikins, and dates the simulation lab was available. The simulation course was conducted in the inpatient simulation laboratory room, and a separate room was used for debriefing and didactic lectures. Room and course size were determined in compliance with COVID-19 restrictions at the time of course delivery.

The researcher and the sim lab staff used the Simulation Module for Assessment of Resident Targeted Event Responses (SMARTER) approach when designing the simulation scenarios. There are eight steps in the SMARTER approach, with the first being selecting an Accreditation Council for Graduate Medical Education (ACGME) core competency to focus on (Rosen et al., 2008). While ACGME focuses on medical education, the competencies can be applied to other areas such as nursing, especially competencies such as patient care and medical knowledge, which was the focus of the study's simulations. The second step is to develop learning objectives that can be measured and are based on the intervention competencies (Rosen

et al., 2008). The researcher developed the learning objectives and skills evaluation tools and had the sim lab staff review them to ensure they met the SMARTER approach. Step three is the clinical context, where the clinical scenarios are developed to meet the learner's objectives (Rosen et al., 2008). The researcher determined the types of patient scenarios needed to meet the learner's objectives, developed the scenarios to meet them, and had the sim lab staff and a sim expert review them for accuracy. Step four is to define the knowledge, skills, and attitudes that determine a good performance (Rosen et al., 2008). As stated above, the researcher developed the scenarios related to the specific traumatic injuries and patient conditions needed to meet the learner objectives. The researcher determined the critical events that would trigger the learner to respond, step five of the SMARTER approach (Rosen et al., 2008). Step six is targeted responses to critical events (Rosen et al., 2008). The researcher and the sim lab staff determined the targeted responses for a critical event based on all available actions. During the scenario, the researcher decided on the targeted response in the moment when a learner had an unexpected answer. An evaluation tool is needed to evaluate the learner's performance in the simulation; therefore, step seven is measurement tools (Rosen et al., 2008). The researcher developed the skills evaluation tools and reviewed them with the sim lab staff and a trauma nursing sim lab expert. The eighth and final step in the SMARTER approach is the scenario script (Rosen et al., 2008). The script describes how the simulation events will unfold, including the patient information, critical events, and targeted responses. The script was developed by the researcher and reviewed by the sim lab staff and a trauma nursing sim lab expert.

Data for UICU admissions (see Appendix I) were obtained from the trauma registry. A query of the trauma registry was done for all trauma patients admitted to the study units during the 90 days after the boot camp was delivered. Another query of the trauma registry was done for

all trauma patients admitted to the study units the 90 days before the study started for comparison data. The Trauma Performance Improvement Coordinator ran the query and sent the data to the research team once the 90-day post-boot camp period had passed.

The International Nursing Association for Clinical Simulation and Learning Standards for Simulation

The International Nursing Association for Clinical Simulation and Learning (INACSL) Standards were followed by the researcher and the sim lab staff in developing, implementing, and evaluating the boot camp simulation scenarios. The first INACSL standard is professional development and focuses on the role of the simulationist. The first standard includes simulator use of needs assessments to determine the educational needs of learners, take part in continuing professional development activities, such as attending conferences and following simulation standards from professional organizations, and staying current on simulation literature (Hallmark et al., 2021). A needs assessment was done before this study by the researcher that was shared with the sim lab staff. The sim lab staff member followed the INACSL and Healthcare Simulation Standards of Best Practices (HSSOBP) standards and was a Certified Healthcare Simulation Educator (CHSE).

The INACSL standard for pre-briefing includes planning and pre-briefing to ensure that learners are informed of the sim lab process, how the manikin works, the location of supplies in the sim room, what the expectations for the scenario are, and to ensure them that they are in a safe place to learn (McDermott et al., 2021). The design standard for the INACSL was met when the sim lab staff and the researcher met during the project planning phase to discuss the project and learner objectives and determine what type of simulation fidelity, room, and equipment would be needed (Watts et al., 2021). The INACSL states that the facilitation of simulations

requires special skills and should follow the HSSOBP (Persico et al., 2021). This standard was met using a CHSE who followed the INACSL and HSSOBP standards, helped determine the cues for the simulation delivery to meet the learner objectives, and facilitated the debriefs. The debrief standard for the INACSL was met by planning the debrief method ahead of time, using a structured debrief method, determining that the sim lab staff would facilitate the debriefs, and using the debriefs to promote self and team reflections on what was and was not known before and after the simulation, and what the learners did well and what they would do differently (Decker et al., 2021). Operations is another INACSL standard. It was met through strategic planning to meet the objectives and goals of the simulation, determining which sim staff members were best suited to help plan and facilitate the simulations, determining which sim lab space best suits the needs of the scenarios, and ensuring that the sim lab policies and protocols followed along with the INACSL standards (Charnetski & Jarvill, 2021). Establishing learner outcomes and objectives through the project curriculum, picking the simulation modality and fidelity to best meet the objectives, understanding the expectations of the simulation, and aligning with the HSSOBP is another INACSL standard met by the sim lab for this project (Miller et al., 2021). The researcher shared the learner and study objectives with the sim lab staff, who provided feedback. They also provided feedback on the developed scenarios and cues to help make the scenarios meet the learner's objectives. They also chose the sim room and agreed that high fidelity was the best option. The INACSL includes professional integrity as a standard (Bowler et al., 2021). This standard was met by following the simulation practice standards set forth by the INACSL and HSSOBP, providing a safe learning environment, and reassuring learners that confidentiality was maintained (Bowler et al., 2021). The INACSL standard of simulation-enhanced interprofessional education was met using trained confederates to play the

interprofessional roles, making this an interprofessional education event (Rossler et al., 2021). Future boot camps or similar courses could be expanded to include other disciplines such as respiratory therapy, physicians, nurse practitioners, or pharmacists. The final INACSL standard is the evaluation of learning and performance that includes determining the method of learner evaluation, which could be formative, summative, or high stakes (McMahon et al., 2021). This standard was met by selecting high-stakes evaluation since the study would be determining skill gaps, be based on the learner objectives, have a predetermined endpoint, use a formally trained evaluator, use a previously used evaluation tool/method, and use one objective observer to rate the simulations through direct observation (McMahon et al., 2021).

Phase II: Intervention

On the day of the study, participants received the simulation scenario-based training course on trauma patient care (i.e., boot camp intervention). The trauma boot camp focused on post-resuscitation care objectives were to 1) recognize deterioration in a trauma patient, 2) perform relevant assessments on the deteriorating trauma patient, 3) intervene appropriately for a deteriorating trauma patient based on assessment findings, and 4) describe the bladder management protocol and how it differs for spinal cord injury patients in comparison to other trauma populations. The course started with a simulation on one of the following areas of focus: troubleshooting a chest tube issue, identifying and treating autonomic dysreflexia in a spinal cord injury, assessing respiratory status in a patient with rib fractures, and correctly using the incentive spirometer to aid in that assessment, performing the bladder management protocol, performing a neuro exam on a traumatic brain injury patient that has a declining mental status, and communicating patient issues to team members effectively. The course had four to five participants in each class due to the simulation lab's COVID-19 restrictions.

The trauma boot camp focused on post-resuscitation care and consisted of three parts: simulation session, debriefing session, and lecture, provided in that order. Simulation sessions (see Appendix E) were performed as a group with the participants acting as the patient's nurse, lasted 5-10 minutes, and were followed by a 5–10-minute debrief. The research team led the simulations while the simulation lab staff facilitated the scenarios and conducted the debriefs. The simulations were scored by an objective simulation and trauma expert, not the researcher or the sim lab staff. The model used for debriefing was the Plus-Delta model, which is used in TeamSTEPPS®, which the researcher and sim lab staff are trained in using for debriefing simulations. Participants discussed what went well (the Plus) and what could have been done better (the Delta) (Agency for Healthcare Research and Quality, 2019). This model has been used by the research team and sim lab staff frequently. During the simulation session, the researcher was in the control room and provided any needed changes to the simulation in response to the subjects' actions that were not addressed in the scenario details. The sim lab staff led the debrief sessions with the researcher in the room. Education related to the simulation occurred as part of the debrief by the sim lab staff and researcher when participants had questions and after they had completed debrief to address clinical issues identified during the simulation.

After the debriefing session, the research team gave a 20–30-minute lecture covering the topics discussed in the preceding simulation scenario. The researcher developed the lecture, focusing on the key points the learners needed to know for trauma patient care using current evidence-based practices. The content of the lectures included caring for patients with rib fractures, caring for and troubleshooting chest tubes, caring for traumatic brain injury patients, performing a neurological exam, and caring for the spinal cord injury patient,

including recognizing and preventing autonomic dysreflexia and how to use the bladder management protocol. In total, the entire boot camp was 4 hours long.

The day continued with four simulation sessions, followed by debriefs and focused lectures relevant to the preceding simulation scenarios. Debrief and lectures were provided each time a simulation scenario session was completed. The lectures covered one of the situations from the previous simulation. The day ended with one final simulation scenario that tied in with the topics covered throughout the day. One final debrief was done as a group before the course concluded. No lecture was provided for the last scenario. The sim lab staff had participants fill out a course evaluation survey per their protocol that the researcher was not present for.

While learners were participating in the simulation scenario, an objective evaluator observed and scored each simulation using a skill evaluation tool specific to each scenario (see Appendix H). Scoring of skill/performance was done as a group, as the simulation was performed as a group. The participants completed all five scenarios, and all five were observed and scored. The skill evaluation tools were placed in an envelope by the objective scorer. The envelope was sealed shut with tape, and the tape was signed by the observer with their name and date to ensure the integrity of the data. The sealed envelopes were then handed to the researcher, who locked them in a cabinet in a locked office that only the researcher had access to until all the simulation groups were completed. Once completed, all the sealed envelopes were handed directly to the HART team member, who would analyze the skills checklist data for the researcher. The HART team then entered the data in REDCap® and correlated it to the participants' evaluation scores and survey results.

Another person was added to the research team after initial IRB approval as the lead

researcher was exposed to COVID-19. To prevent the course from being delayed, one of the researcher's project committee members was added as faculty to the course so they could teach and lead the simulations if the lead researcher tested positive for COVID-19. In the end, the backup instructor was not needed, and the course proceeded with the lead researcher as planned.

Phase III: Post-Intervention

After course completion, the participants were emailed another link via REDCap® for the post-confidence evaluation tools (see Appendix E and F), post-knowledge evaluation tool (see Appendix D), and course evaluation survey (see Appendix F). At 30, 60, and 90 days after course completion, links were emailed to participants via REDCap® with knowledge evaluation tools (see Appendix D) and confidence evaluation tools (see Appendix E). Email reminders were sent to participants weekly until 3 weeks after the final 90-day link was sent.

Due to the low response rate from participants on the knowledge evaluation tools, confidence evaluation tools, and course evaluation survey, the research team sought IRB approval to use the simulation lab's course evaluation data. Approval was given, and the raw and aggregate course evaluation data from the simulation lab were sent directly to the HART team member.

Study Instruments

Demographic Data Survey

The demographic data survey is an eight-question tool (see Appendix C) developed by the study researchers to collect participants' demographic characteristics and trauma patient care experiences. It included gender, age, highest nursing degree, attainment of nursing certificate relevant to trauma patient care, years of experience as a nurse, years of experience as a nurse on the current unit, previous experience in trauma patient care, and years of previous trauma patient

care experiences. Gender, previous trauma education, and previous experience with trauma patients used nominal data. Gender options included male, female, other, and prefer not to answer. The variable to report a previous trauma education and experience with trauma patient care were answered as yes/no option. Age, years as a nurse, years as a nurse on the unit, and years of previous trauma experience were reported as raw data, using the closest whole number. The level of education included diplomas, associate's, bachelor's, and master's degrees, and like gender, were coded as nominal data and were reported based on the highest degree obtained. Certifications obtained through professional organizations included Critical Care Registered Nurse, Progressive Care Certified Nurse, Trauma Certified Registered Nurse, and others with the option to choose all answer options that applied. It used yes/no questions and was coded as nominal data.

Knowledge Evaluation Tool

The knowledge evaluation tool (see Appendix D) was developed by the study researcher and consisted of a total of 10 questions. The level of measurement for the test scores was ratio and used the raw numbers with no rounding. REDCap® scored the test. The pre- and post-tests for knowledge included the same questions; however, the order of questions and answers was randomly organized to minimize memorization of the questions and answers. Scores were presented as percentages correct, ranging from 0 to 100, based on the number of questions answered correctly. The closer to 100 a participant scored, the better their knowledge retention was. Scores closer to 0 indicated a lack of knowledge retention. Questions not answered were thrown out, and the score was calculated based on the number of correct answers out of the total number of questions answered so as not to skew the results. A nursing trauma expert reviewed the knowledge evaluation tool for content validity. Psychometric testing was not conducted for

the knowledge assessment tool.

Confidence Evaluation Tools

Student Satisfaction and Self-Confidence in Learning. The Student Satisfaction and Self-Confidence in Learning (see Appendix E), provided by the National League of Nursing (NLN) website, is a 13-item instrument consisting of five questions for satisfaction and eight for self-confidence measures (National League of Nursing, 2021a). Each item was scored using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree). Therefore, scores for confidence levels ranged from one to five, with the lowest possible score of 13 and the highest possible score of 65. The higher the score is for confidence levels, the more confident the participant is with caring for those areas of focus. This instrument was reported to have reliability tested using Cronbach's Alpha, with a satisfaction score of 0.84 and confidence of 0.87 (National League of Nursing, 2021a). Permission to use the tool was not required per the National League of Nursing website if the tool was used for non-commercial use and the source was cited correctly when published (National League of Nursing, 2021b). Once participants completed the evaluation tool, REDCap® automatically scored the answers for confidence evaluation.

Trauma Specific Confidence Evaluation Tool. This confidence evaluation tool was developed by the researcher and was based on prior tools used by the research in other trauma-related SBT classes. Self-reported confidence levels related to six specific skills of traumatic patient care were also measured, but only before and after the simulation-based training course. Topics/skills asked for confidence levels in six areas, including troubleshooting chest tubes, using the bladder management protocol, performing a neurological exam, teaching incentive spirometry, EPIC documentation, and team communication (see the latter half part of Appendix

F). Self-confidence levels for the specific-skills confidence levels were measured using a 5-point Likert scale. Therefore, scores for specific-skill confidence levels ranged from one to five, with the lowest possible score of six and the highest possible score of 30. Psychometric testing was not conducted for the Trauma Specific Confidence Evaluation Tool.

Simulation Laboratory Course Evaluation Tool. The sim lab course evaluation tool (see Appendix G) was developed by the sim lab's director and one of the sim lab team members. The sim lab course evaluation tool is course objective driven and included participants' ability to recognize deterioration in a trauma patient, ability to perform relevant assessments on the deteriorating trauma patient, ability to intervene appropriately for a deteriorating trauma patient based on assessment findings, and ability to describe the bladder management protocol and how it differs for spinal cord injury patients. Self-confidence levels for the sim lab confidence levels were measured using a 5-point Likert scale (1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high). Therefore, scores for specific-skill confidence levels ranged from one to five, with the lowest possible score of four and the highest possible score of 20. Psychometric testing was not conducted for the Simulation Laboratory Course Evaluation Tool.

Skill Performance Evaluation Tool

The skill performance evaluation tools (see Appendix H) included the scenario or case information with triggers and targeted clinical response skill checklists. They scored one point whenever the group participating in each scenario hit the targeted clinical response/skill. The skills evaluation tools were scored as percentages of the number correct out of the total number of points. Missed checklist items were reviewed to determine if one area was overlooked more often than another. Psychometric testing was not conducted for the Skill Performance Evaluation Tools.

UICU Admission Trauma Registry Data

Unplanned ICU admissions or upgrades to ICU (see Appendix I) used percentages and types. The trauma registry data included age, Injury Severity Score (ISS), Trauma Revised Injury Severity Score (TRISS), ICU length of stay (LOS), number of ICU visits, hospital length of stay (HLOS), number of ventilator days, UICU intubation, the reason for UICU, and discharge status. The UICU admission Trauma Registry Data was used to examine the unplanned ICU admission rates and other related outcomes among trauma patients admitted during study periods.

Data Collection and Data Security

Data collection for the knowledge, confidence, and skills evaluation tools and the demographic and course evaluation surveys started on January 5, 2022, and ended on May 25, 2022. Unplanned ICU admission data collection periods were October 6, 2021, to January 4, 2022, for the pre-intervention period, and February 4, 2022, to May 5, 2022, for the post-intervention period. The Trauma Performance Improvement Coordinator ran the query and stored the data securely on the research study shared drive that only the research team and HART could access. The trauma patients' unplanned ICU admission data (see Appendix I) was stored in a shared drive housed in the hospital system's mainframe. The study shared drive was password-protected and only accessible by the research team and HART to ensure the data was secure.

Data collection was done via REDCap® for all five pre-post knowledge evaluation tools and pre-post confidence evaluation tools. The database, including knowledge evaluation tools (see Appendix D), confidence evaluation tools (see Appendix E and F), the demographic survey, and the course evaluation survey (see Appendix F), were built and stored in REDCap® by the HART team. REDCap® also was used to track the skills evaluation tool scores and store them. The HART team was given a list of the participants' names and emails, units, and the date and

time they attended the boot camp. The HART team entered all information into REDCap®. They also sent out the email links with the evaluation tools and surveys before the boot camp started, after its completion, and at the 30-, 60-, and 90-day intervals based on the days the participants were scheduled to attend the class. The HART team also entered all the skills evaluation tools data once they received the scoring sheets from the research team. They then merged the simulation scores to the knowledge and confidence evaluation tools, so all data points were grouped (M. Salamoun, personal communication, July 19, 2021). Data was kept for the length of time designated by the study facility/organization. REDCap® also kept the list of participants sent to the research team by the unit directors.

REDCap® is a secure, web-based data collection tool that is password-protected. Only HART had access to the original study database to protect the data and ensure participant confidentiality, including identifiable information in RedCap®. REDCap® automatically assigned subjects an identification number the first time they signed into REDCap®, and data was de-identified. The research team could not access the REDCap® database, and data were only reported using the de-identified identification number assigned to the participant. Therefore, the research team was unaware of whose tests and evaluations they were viewing (M. Salamoun, personal communication, July 19, 2021). REDCap® automatically assigned the study identification number for the same participant, so the pre-post knowledge and confidence evaluation tools scores and evaluation surveys were grouped with the same subject. Using REDCap® ensured that the data was secured and collected at the same time every time to address fidelity. Subjects were only identified by a number, protecting their confidentiality from the researcher.

Evaluation Plan

Variables

The independent variable was the trauma boot camp focused on post-resuscitation care. The dependent variables were the knowledge evaluation tool scores (see Appendix D), skill evaluation tool (see Appendix H), confidence evaluation tool scores (see Appendix E and F), and UICU admissions (see Appendix I). In addition to the independent and dependent variables, several other variables were collected and analyzed. Those variables (see Appendix C and I) included gender, age, years as a nurse, years as a nurse on the unit, education level, certifications, previous trauma experience, previous trauma education, unit characteristics, and UICU characteristics.

Operational Definitions

Knowledge retention was defined by improved test scores (see Appendix D) from pre- to post-test and maintaining those post-test scores at 30, 60, and 90 days. Skill was defined as the percentage of correct hit points as a group in each scenario. The improvement of skill performance was defined when the percentage of correct hit points as a group was increased from the first simulation to the last one during the simulation course (see Appendix H). Confidence retention was defined when having improved self-reported confidence in learning levels (see Appendix E and F) from pre- to post-course and maintaining those post-intervention scores at 30, 60, and 90 days post-course. An unexpected admission or upgrade to ICU was referred to when a trauma patient had a status decline requiring a higher level of care than anticipated, as defined by the American College of Surgeon Trauma Quality Improvement Program National Trauma Data Bank. For example, when a trauma patient is readmitted to the ICU with respiratory distress, it is considered an unplanned ICU admission. Improvement of UICU admission is defined by a reduction in the number of UICU trauma

admissions related to failure to rescue by nursing from 90 days pre-intervention to 90 days post-intervention.

Data Management for Analysis

The data cleaning process occurred before analysis by the research team. The knowledge test score calculations included the number right out of the number answered, assuming that the subject missed the question if it was left unanswered. The score was calculated from total correct answers out of total answered, instead of all questions, to ensure an accurate depiction of knowledge retention. Similarly, confidence evaluation tool questions not answered were also left out, with the analysis done on only the answered items. For confidence evaluation tools, when items were left blank either in the pre- or post-test, the questions/items were excluded for the analysis, so the remaining data was not skewed for pre-post comparison analysis. Outliers were removed for further analysis to understand the results better.

Statistical Analysis

Descriptive Statistic Analysis

Frequency and percentages were used to analyze the nominal and categorical variables such as gender, highest education degree, certificate obtained, and the reason for UICU admission. Mean and standard deviations, along with range, were used to analyze the ordinal or the continuous/ratio variables such as age, test scores for knowledge, confidence, and skill.

Inferential Statistic Analysis

Aim One (Knowledge). Paired t-test was used to evaluate if there was a difference in knowledge score before and after the boot camp and to determine the effect of the trauma boot camp on knowledge. In addition, repeated measures (RM)-ANOVA was used to measure knowledge retention throughout the study period to evaluate if there was a difference in

knowledge scores among datasets at baseline, post-0, 30, 60, and 90 days. When a discrepancy exists with a p-value of 0.05, a post-hoc paired comparison was used between pre-test and post-test datasets to identify where the difference exists among the five dataset groups.

Aim Two (Confidence). The paired t-test was used to determine if there was a difference in confidence scores before and after the training for two confidence surveys (the NLNs and the researcher's). Confidence was also measured using the NLN survey at baseline, post-0, 30, 60, and 90 days, so RM-ANOVA was used to evaluate if there was a difference in confidence amongst the datasets at baseline, post-0, 30, 60, and 90 days. When a difference exists with a p-value of 0.05, a post-hoc paired comparison was used between the pre-test and the four post-test datasets to identify where the difference exists among the five dataset groups. The Wilcoxon Signed Rank Test was used to evaluate if there was a difference in confidence scores of the sim lab's confidence evaluation tool from pre- to post-boot camp.

Aim Three (Skill). Wilcoxon Signed Rank Test was used to evaluate if there was a difference in percentage score of skill performance between the first and final simulations to determine the effect of trauma training courses on skill performance.

Aim Four (Unplanned ICU Admission). UICU data was compared 90 days pre-intervention and 90 days post-intervention. Fisher's Exact Test was used to evaluate if there was a difference in the number of UICU admissions pre-to-post-intervention and for categorical variables when comparing UICU admission characteristics. The Wilcoxon Two-Sample test was used to compare numerical variables for UICU admission characteristics between pre- and post-intervention UICU admissions.

Chapter Four: Results

Of the 20 participants, only four participated in the research study. One participant completed all five knowledge and confidence evaluation tools and the demographic and course evaluation surveys. However, they chose not to be included in the study. The four participants that agreed to participate in the study completed the demographic survey. Of the four, only one completed four of the five knowledge and confidence evaluation tools and the final course evaluation survey. Three completed the pre- and post-knowledge and confidence evaluation tools. Two participants completed pre-, post-, and 30-day knowledge and confidence evaluation tools. None of the participants completed the 60-day knowledge and confidence evaluation tools. Due to the lack of response, there was insufficient data to run a statistical analysis on the knowledge and the NLN and researcher's confidence evaluation tools or the demographic surveys sent via REDCap®.

All 20 participants completed the sim lab course evaluation; therefore, the data were analyzed using the Wilcoxon Signed-Rank Test using R Studio (2022.02.3 492, Boston, MA). Overall, there was a statistically significant improvement in confidence in all four areas evaluated by the sim lab confidence evaluation (see Table 1).

Table 1

Participant's ability to:	Pre-Boot Camp Median	Post-Boot Camp Median	P-value
Recognize deterioration in a trauma patient	3	4	*p = 0.0001*
Perform relevant assessments on the deteriorating trauma patient	3	4	*p = 0.0002*
Intervene appropriately for a deteriorating trauma patient	3	4	*p = 0.0003*
Describe the bladder management protocol & how it differs for spinal cord injury patients	3	5	*p = 0.0001*

Analysis of Sim Lab Evaluation Tool

The skills/performance evaluation tool scores did not significantly improve when comparing the first simulation to the final simulation (p = 0.6721). Overall, five of the seven groups tested had some improvement (median % change) from the first to the last simulation, while the other two groups had a decline in scores (see Table 2). When comparing the combined skills scores for all groups, the first simulation score had a percent median score of 70.59% versus the last simulation score, which has a percent median of 81.48%.

Table 2

Analysis of Skills/Performance Evaluation Tool

Sim Group	% Change from 1st to last Sim
A	11.5%
B	16.8%
C	8.7%
D	10.9%
E	10.9%
F	-12.0%
G	-12.6%

Sim Lab 1st Score % Median = 70.59%
Sim Lab Last Score % Median = 81.48%
p-value = 0.6721

The sim lab evaluation tool also collected comments from participants. Several participants commented that the boot camp is great for new nurses and should be done sometime during or shortly after orientation.

"Great for new grad training."

"I think the sim was helpful and should be done within a couple of months of coming off orientation."

Participants also mentioned how beneficial they found the education and the format used for the class.

"Loved that we did a scenario then debriefed."

"I really appreciated the chest tube education."

One of the unit directors also gave feedback about how well her staff enjoyed the class. Several nurses shared with her that they found the experience helpful, engaging, and informative (K. Reese, personal communication, February 4, 2022).

Fisher's Exact Test analyzed the total number of UICU admission events pre- to post-intervention. There was a total N of 331 trauma admissions to the study units in the pre-intervention phase and 174 in the post-intervention phase. Of the total trauma admissions, a higher frequency of UICU admissions occurred in the post-intervention time period (pre = 4.8% vs. post = 10.9%, p = 0.0155; see Table 3).

Table 3

Number of UICU Admissions

	Pre (n, %)	Post (n, %)
UICU No	315 (95.2)	155 (89.1)
UICU Yes	16 (4.8)	19 (10.9)

p-value = 0.0155

There were no statistically significant differences when comparing pre- to post-boot camp UICU admission data on the following: age, ISS, TRISS, ICU LOS, number of ICU visits, HLOS, number of ventilator days, intubation during UICU admission, and reason for UICU admission (see Table 4). The pre-boot camp UICU admission data did not include cardiac arrest events (n = 0, 0%); however, the post-boot camp reason for admission included four patients that were upgraded due to cardiac arrest (21.1%). Respiratory compromise accounted for 50.0% in the pre-boot camp group, but only 36.8% in the post-boot camp group.

Table 4

Analysis of UICU Admissions

	Pre	Post	p-value
Age	75.5 (16.5)	71 (18)	0.3600
ISS*	9.5 (10.5)	9 (17)	0.5506
TRISS**	0.97 (0.02)	0.97 (0.01)	0.1605
ICU LOS***	6.5 (11.5)	9 (13)	0.3101
ICU Visits	1 (1)	1 (1)	0.3023
HLOS┼	16.5 (17)	18 (23)	0.2346
Ventilator Days	3 (4)	2 (17)	0.4938
Discharge Status			0.6772
Alive	12 (75.0%)	16 (84.2%)	
Dead	4 (25.0%)	3 (15.8%)	
UICU Intubation			0.7267
No	11 (68.8%)	11 (57.9%)	
Yes	5 (31.3%)	8 (42.1%)	
UICU Reason			0.1901
Cardiac Arrest	0 (0.0%)	**4 (21.1%)**	
Respiratory	8 (50.0%)	7 (36.8%)	
Other	8 (50.0%)	8 (42.1%)	

Median (IQR) – Numeric Variables (Wilcoxon Two-Sample Test)
(%) – Categorical Variable (Fisher's Exact Test)
*ISS- Injury Severity Score
**TRISS- Trauma Revised Injury Severity Score
***ICU LOS-Intensive Care Unit Length of Stay
┼HLOS-Hospital Length of Stay

Chapter Five: Conclusions

Discussion

This study demonstrated the positive effect of the study design on improving nurses' confidence in caring for patients with traumatic injuries. Therefore, the alternate hypothesis was confirmed that a trauma boot camp focused on post-resuscitation care will affect the confidence levels of nurses working in inpatient surgical units. This finding supports previous findings that SBT positively affects confidence levels in nurses (Harvey et al., 2019; Hsu et al., 2015; Hustad et al., 2019; Kim & Shin, 2016; Rice et al., 2016). The boot camp was focused on newer nurses, who may be more anxious and less confident. Confidence is essential for nurses, as low confidence levels have been linked to delays in care and the inability to intervene when a patient deteriorates (Crowe et al., 2018). Improving nurses' confidence may reduce FTR events by increasing nurses' ability to think critically and enhance their clinical judgment and decision-making (Guerrero et al., 2022). This study is the first to explore the impact of a post-resuscitation trauma specific boot camp on confidence levels in new trauma.

When comparing the first scenario to the final scenario, there was no improvement in skills. The lack of improvement proves the null hypothesis that a trauma boot camp focused on post-resuscitation care will not affect the skill level of nurses working in the inpatient surgical units. However, five of the seven groups did demonstrate improvement, whereas two groups had a decline. This finding was not expected as much of the literature shows the positive impact SBT has on improving nurses' skill competence (Abe et al., 2013; Abelsson et al., 2017; Hegland et al., 2017; Jyoti et al., 2021; Kim & Shin, 2016; Parikh et al., 2022). The study design was different than the usual SBT used in prior comparison studies. This study had the simulations and debriefs before the lectures, which is not a standard format for SBT (Garvey et al., 2016; Rice et

al., 2016), whereas the usual SBT format is a lecture followed by simulations and debriefs (Abe et al., 2013; Bodine & Miller, 2017; Connell et al., 2016). This study may not have improved skills because the first and last simulations differed. The first simulation case was a rib fracture scenario. In contrast, the final simulation case pulled together everything from the boot camp in one final scenario. These limitations can be addressed in the future by having the first and last simulation measure the same items for consistency.

A validated measurement tool is highly recommended when measuring skill performance (Chang et al., 2018). According to the American Heart Association, developing an objective measurement tool for skill performance and implementing it can be a logistical nightmare (Chang et al., 2018). The measurement tool's validity is crucial but challenging to obtain since tools vary based on population, focus, content, and so on, and the validation process is lengthy (Chang et al., 2018). The tools used in this study were structured using evidence-based SMARTER methodology and content validated by a trauma nursing expert; however, lack of formal tool psychometric testing may account for the lack of significant findings.

A potentially significant confounding variable that may have impacted skill performance was that the simulation groups were of a mixed composition, with some groups being comprised of staff members from the same study unit and others being from all three study units. Team skill performance may have been higher in simulation groups comprised of nurses who work together on a daily basis. A second confounding variable is the sample included nurses with less than 3 years of nursing experience; however, variation in skill level within groups may have made an impact. Some groups had only 6 months' experience, and others had more than 2 or 3 years' experience. The groups with nurses with more experience may have scored higher as the more experienced nurses would be more confident in their knowledge and skills and have higher levels

of critical thinking compared to their less experienced counterparts. Corelating simulation group characteristics with nurse trauma nurse team performance provides direction for future research.

There was a significant increase in UICU admission rates from pre- to post-trauma boot camp, thus confirming the alternate hypothesis that a trauma boot camp focused on a post-resuscitation care will affect unit-based trauma unplanned ICU admissions. The finding was surprising since simulation has been proven to increase nurses' ability to recognize and rescue a deteriorating patient (Connell et al., 2016; Kelsey & Claus, 2016; Liaw et al., 2016). Therefore, the researcher expected a decline in UICU admissions from pre- to post-trauma boot camp. Several factors may have influenced these unexpected findings.

Respiratory issues are the most common cause of UICU admission in trauma patients (Duverseau et al., 2019). Respiratory issues related to pneumonia and adult respiratory distress syndrome, cardiovascular complications, and sepsis are risk factors for having an FTR event (Roussas et al., 2020). In geriatric trauma patients, frailty triples their risk of FTR and alone can cause FTR (Roussas et al., 2020). In trauma patients, older age and respiratory issues were significant indicators of FTR (Smith et al., 2019). Respiratory issues accounted for 50% of the pre-boot camp group's reason for UICU admission but only 36.8% in the post-boot camp group, which trended towards significance. The post-boot camp group also had patients that experienced cardiac arrest (21.1%), while the pre-boot camp group did not, which may account for the higher-than-expected UICU admission rates in the post-boot camp group. The course content did not cover cardiac events, only respiratory and neurological events, which may account for the increase in UICU admissions in the post-boot camp group.

The lecture content focused on specific areas related to trauma care but did not include all of the 10 signs of vitality content. The 10 signs of vitality is an approach to early recognition of

patient deterioration, which can help prevent UICU admissions (Vandergrift et al., 2021). The study facility uses the 10 signs of vitality model for recognition of early clinical decline and includes this in new hire nurse orientation. Adding the additional content that focuses on the entire 10 signs of vitality and the primary causes of FTR for future trauma boot camps may help address these issues.

Johnston et al. (2015) found that as staffing levels decreased, FTR rates increased, but as hospital volumes decreased, FTR rates did as well. Staffing turnover has been an issue at the study facility, which may contribute to increased FTR rates. Comparing the staffing turnover rates during the pre-intervention phase to the post-intervention phase may support the increased FTR rates if turnover had increased during that time. Comparing hospital volume during those same periods may also support the rise in FTR numbers if the volume had increased from pre- to post-intervention.

Limitations of Study

This study had several limitations, the main one being that it was unable to determine the effects of the boot camp on knowledge due to low response rates by participants. Lack of response may be due to survey fatigue or a lack of free time during the workday to answer surveys (Anusiewicz et al., 2021). Survey fatigue is "overexposure to the survey process, in which people become overwhelmed by the number of surveys they encounter in daily life and that they thus become fatigued" (Karlberg, 2015, p. 2). Post-COVID-19 survey response rates are significantly less than pre-COVID-19 (de Koning et al., 2021). Most surveys had an average of 25 questions, were multiple-choice, and were sent by email to participants. de Koning et al. (2021) found that the increase in surveys during the COVID-19 period led to increased survey fatigue, causing reduced response rates and data collection quality. Survey fatigue leads to a lack

of participation or participants not completing or withdrawing from the study before it is over (Field, 2020). Being invited to participate in multiple surveys, such as in this study, can also lead to participant dropout (Field, 2020). This study had five survey links sent out with 23 questions on the knowledge and confidence evaluation tools, not counting the demographic or course evaluation surveys. This may explain the low response rates and the attrition of the four participants over time. Work time, and changes in workload, especially post-COVID-19, have led to less free time at work to complete surveys, and staff may see participating in a survey off the clock as a disturbance in their work/life balance (Anusiewicz, 2021; Field, 2020). As noted earlier, staffing turnover has been an issue the study nursing units are dealing with, which may mean a heavier workload for the nurses and may account for the lack of response rates for this study.

Since it was a pilot study, the sample size was small, and single center setting during a pandemic limits generalizability. The study design employed a convenience sample, so randomization of participants did not occur. Convenience samples make it difficult to generalize the findings to the population as a whole (Polit, 2010).

Finally, the course was a requirement for participants instead of voluntary, which may bias results. Participants were able to opt out of the tests and surveys to help reduce the potential for bias. There was also a low response rate related to the tests, surveys, and course evaluation sent out via REDCap®, making it difficult to determine the actual effectiveness of this study.

Implications for Practice

This study researched a different teaching format using SBT. Instead of the traditional lecture, simulation, then debrief, this study switched it up and started with a simulation followed by debriefing, then lecture. The boot camp repeated this format for four rounds with one final

simulation. Participants shared they liked this format as it made them more aware of what they thought they knew but did not. The boot camp increased new nurses' confidence levels when caring for trauma patients; however, it did not show improvements in knowledge, skill level, or UICU admissions. This format can be replicated and applied in other areas of nursing to help new nurses transition into their practice. The author recommends offering the course after orientation but within the first 6 months of hire, if possible, based on participant feedback.

Recommendations for Further Research

Further research is needed using this study's design to train inpatient nurses caring for trauma patients. The researcher recommends using the same scenario for the first and final scenarios to demonstrate skill attainment better. Adding the knowledge evaluation tool on paper as part of the boot camp will also ensure that knowledge attainment data is collected. The same could be done for the confidence evaluation tool and demographic and course evaluation surveys. The tools and surveys could be done on paper the day of class, so pre- and post-data are collected to get an adequate sample size. The design used in this study can also be replicated in all areas of nursing, not just trauma, including nursing academia.

Conclusions

Few researchers have studied simulation's effect on the education of inpatient nurses on how to care for trauma patients' post-resuscitation. While there were numerous studies on simulation, few used the format of simulation and debrief, followed by focused education that is repeated for four rounds followed by a final simulation. While this format did not impact skill level or UICU admissions, it significantly impacted confidence levels in inpatient trauma nurses. Further research is needed to determine the true impact of the trauma boot camp on knowledge, skills, and UICU admissions.

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Appendix A

Evidence Tables

Article No.	Author Year	Purpose of Study	Conceptual Framework	Study Design Sample Setting	Major Variables	Measurement of Variable Data	Study Findings	Strength/Weakness Conclusion
1	Abe, Y., 2013	To determine the effect of simulation on nurses' competency in Japan related to cardiovascular critical care nursing. Examine whether repeated simulations using a grading rubric improved nursing competency. Examine the effect of using simulation on nurses' perceptions of teamwork in routine nursing care.	None mentioned.	Prospective open label study. Division of participants into four groups that rotated through four different simulations made up the sample. Debriefings occurred after each rotation. Performance was rated using a rubric. Completion of the Teamwork Activity Inventory in Nursing Scale (TAINS) occurred pre- and post-	IV Simulation DV1 Nursing Competency-skills and abilities. DV2 Teamwork in routine nursing care in their workplace. No definition provided.	DV1 Rubric scored on 4 level scale with 1 being not done and 4 being well done. DV2 TAINS by Takayama and Takeo. Article reports reliability was validated in Japan, but no measurement data was mentioned. Medians, Wilcoxon signed-rank test, Cronbach α	DV1 All groups had low mean rubric scores (range 16.0-18.7) in the first simulation. By the fourth simulation the mean rubric scores ranged from 22.7-27.7. There was no statistical analysis done comparing rubric scores outside of reporting the mean score. DV2 Cronbach α for 6 subscale items before and after all rotations were 0.7 or higher. Subscale items "attitudes of the superior" and "Confidence as a team member" had strong significant differences ($p<.01$) pre to post. Subscale item "Job satisfaction" had a significant difference pre to post with a $p<.05$. Overall, the repeated scenario simulation method improved clinical performance and nontechnical skills, such as teamwork.	LOE III Use of a validated tool (TAINS) and scoring rubric to ensure standardization across faculty/small sample size, single setting, participants volunteered. Little to no risk or harm to participants if study is adopted. Very feasible to my practice as repeated simulations is part of my DNP project. Overall, repeated simulations had a positive effect on nursing competency in both technical and nontechnical skills. Although, I would have like to have statistical analysis of the grading rubric to see exactly how much of an effect simulation had on nursing competency. Recommendation-further study with a larger sample size, preferably multicenter that has statistical analysis of all the data collected. I would also recommend having the faculty grade participants using the same rubric to compare difference between self, peer and faculty rubric scores.

				simulation. Japanese nurses at a university hospital working a cardiovascular critical care unit. N=24. No attrition is mentioned in the article.				
2	Abelsson, 2017.	To determine the effect of trauma simulation participation on trauma care skills in nurses working in prehospital care. To also examine the association between the frequency of trauma simulation and the effect of trauma simulation on trauma care skills in prehospital emergency nurses.	None mentioned.	Intervention study. Simulation was done with two separate groups. The first group completed four simulations with each one 8 weeks apart. The second group did the 1st and 4th simulations at 6 month intervals. Evaluations were	IV Simulation DV Trauma skills	IV Trauma surgeon and anesthesiologist specializing in prehospital emergency care assisted in scenario development to ensure content validity. They were then piloted by 4 nurses that did not participate in the study. DV Global Rating Scale (GRS) for assessment of paramedic clinical competence by Tavares et al; 2013, was used to score trauma skills competence. Interrater reliability was reported as Kappa of 0.75 to 0.94 and internal consistency as Cronbach α of	P <0.5 comparing first simulation to last simulation in inspection of chest for both groups. The group that only had 2 simulations total had a significant decrease in exam of the pelvis ($p<.05$). Statically significant ($p<.05$) improvement for the first group from the 1st to the last simulation. Overall, group A with a simulation once every 8 weeks had statistically significant ($p<.05$) improvement in their skills when compared to the group that had 2 simulations 6 months apart. Frequency of simulation has a positive effect on trauma skills in prehospital emergency nurses.	LOE Tested interrater reliability, used a validated tool (GRS), use of content experts to review flowcharts and build simulations and piloting the simulations prior to study start/small sample size, single center, participants volunteered, data tables detract from the article. This study is feasible for my practice since I work with emergency nurses and EMS. This can be easily translated to nursing in the hospital as well. Simulations done on a more frequent basis improve skills related to trauma care. Recommendation: Further study with a larger sample size, and at more than one center. Data tables are very busy and do not provide any

				done during the 1st and 4th simulation. Simulations were done in pairs with one doing the assessment and the other acting under the direction of the first person. Scenarios lasted 2-11 minutes. Debriefing followed simulation end. Convenience sample. Assigned to groups based on geographic location. Nurses in prehospital care. N=63. 27 in one group and 36 in the		0.53-0.89. Flowchart for ABCDE was also used to grade patient assessment, examinations, and care interventions that participants were expected to perform. Validated by having an emergency physician review the flowchart prior to use. Interrater reliability was tested and found to be 95%.		statistical analysis to the ready so revising them or discussing the actual statistical test results in the results section would be helpful to the reader

				other. From 5 ambulance bases in 3 regions in Sweden. Nurses volunteered to take part. 18 were lost to attrition due to maternity leave (n=3), left EMS (n=15).				
3.	Abelsson, A. (2018).	To determine nurse's perceptions of trauma care using simulation in prehospital emergency care.	Simulation model by Dieckmann.	Qualitative, phenomenographic method. Nurses who participated in the repeated simulation study done by the authors. N=20	IV Nurses perceptions related to learning through simulation, learning through observation, learning through debriefing, and learning in a simulated environment. DV Simulation as described in the previous study using 4 groups with two 3 member teams rotated through 4 zones or simulation scenarios.	Interviews were conducted at the end of the simulations during working hours with 2 participants at a time. An open-ended question started the interview with subsequent questions based on participants responses. Interviews lasted 21-34 minutes and were recorded and transcribed by the first author. Two authors read transcripts and found select quotes and pooled meanings were identified then categorized based on similarity.	Nurses felt that simulation enabled their learning, helped them gain knowledge and skills related to trauma care, and how to prioritize patients. Nurses also felt that repeated simulation taught them how to respond, what to look for and what to anticipate. The repeated simulations provided easier recall in actual patient care.	II Study was a follow up to an earlier study, so it helped strengthen the quantitative study/Small sample size, used volunteers, and single setting. This is a feasible method that can be employed by any researcher. I could use this method to determine how subjects perceived my DNP project. Very minimal risk to participants outside of discomfort of speaking openly to the interviewer running the study. Nurses found simulation to be a very effective method to improving their knowledge as well as their time to retrieving that knowledge in a high stress trauma setting.

					Step 1 groups were given brief case information . Step 2 first 3 people in the group did the simulation with debriefing while the other 3 in the group observed. Step 3 those who did the simulation used the rubric to grade themselves. Step 4 Post simulation debriefing occurred with just those who did the simulation with faculty and observers providing feedback. Step 5 observers now take part in a simulation. Step 6 second group grades their own performanc e with the rubric. Step 7 actions in step 4 repeated. Debriefing occurred			I recommend more qualitative studies following quantitative ones to determine what value the participants placed on the intervention. It can further identify the effectiveness of the intervention.

					right after the simulation.			
4.	Alluri, R (2016).	To compare the efficacy of simulation versus lecture-based education among preclinical medical students.	None mentioned.	Randomized controlled crossover study Second year medical students enrolled in the Cardiovascular, renal, and respiratory medicine II course at UCLA that volunteered. N=20. Four students lost to attrition for the delayed test but were still included in the pre-post analysis	IV1 Simulation Each group had 2 simulator sessions and rotated through 4 scenarios with the same instructor. Each scenario was 20 minutes followed by a 10 minute debrief. IV1 Lecture each group had 2 lecture based sessions that were 30 minutes each. DV2 Knowledge gain from pre to immediately post course completion using a 12 item multiple choice question test. DV3 Long-term knowledge retention at 5 weeks using a 12 item multiple choice question test.	DV1 Test pre and post class with 12 multiple choice questions. DV2 Test at 5 weeks after course completion with 12 multiple choice questions Test scores were averaged as percentages for pre, post, and delay post and then compared. Average change for each test for simulation compared to lecture was also calculated. A cross method comparison of the average change was done for the tests for simulation and lecture. A two-tailed students t-test was used as well as a Shapiro-Wilks test for normalcy. SPSS was used and significance was set at a $p < .05$.	Both groups had significant improvement ($p=0.023$, $p=.0001$) from pre to post test. When compared to lectures, high fidelity simulations provided immediate knowledge gain along with long-term knowledge retention ($p=0.036$).	II Test questions were built off of a test bank of questions developed by the authors off the main teaching objectives. The bank was used to provide random test questions for 3 tests to reduce bias based on memorization. Tests were closed book with a proctor to reduce bias related to cheating/Small sample size, single center, subjects volunteered. This study is feasible but would take more resources than other studies reviewed in this paper as there was 1 faculty member for each of the scenarios and 1 for each of the lectures. While lectures had the same impact on immediate knowledge gain, simulations proved to be more effective on long-term knowledge retention. Further study is needed to determine if the study findings can be replicated. Previous studies have shown simulation to be an effective method for knowledge gain. Repeating this study but using a comparison study with a control group for the lecture may strengthen the

								findings of this article.
5.	Bodine, J.L. (2017).	To determine which of two educational approaches to the ELNEC course is more effective in increasing emergency nurse's knowledge related to EOL care.	Benner's model of novice to expert was used to divided the nurses into groups.	Quantitative, cross-sectional, descriptive design Convenience sample of emergency nurses from a level I trauma center who volunteered to participate. N=53	IV1 Lecture-3 eight hour lecture days IV2 Lecture plus simulation-same as IV 1 with the addition of 2 simulations. DV1 Knowledge-test score improvement from pre to post test	DV1 the ELNEC abbreviated 25 question test was used to measure knowledge gain for both IV1 and IV2 SPSS. Independent t tests. Descriptive statistics, Mann-Whitney U tests, Levene's test, dependent t tests with boot strapping.	There was no significant difference in knowledge gain when comparing lecture to lecture plus simulation ($p > .05$). However, there was statistically significant knowledge gain ($p < .05$) for both groups when comparing scores separately by group. Statistically significant improvement was found between mean EOL scores and post ELNEC training mean scores for the whole sample ($p < .016$).	III Use of a standardized course and test from ELNEC, simulations based on real life situations, use of standardized family member, physician, and high fidelity sim man. Subjects randomly assigned themselves to groups based on which day they chose to attend the course /A natural bias, zone in which nurses worked in the ER could bias results, small sample, test was not piloted, open dialogue in each course could have provided different experiences, thus biasing results, nurses volunteered This is a very feasible study as the course used the ELNEC curriculum and test which is already developed. Use of real life situations from their facility for simulations made the content more relevant to the subjects. While there were no differences in test scores between groups pre-post, both groups showed improvement in knowledge, demonstrating that either method is effective.
6.	Courteille, J. (2018).	To compare medical students' and	None mentioned.	Randomized control Fourth year	IV1 Virtual patient training using a standardize	DV1 12 multiple choice question test after the intervention and another test at	There was no difference in knowledge gain on test 1 ($p>.05$) when using a virtual	II Large sample size, random assignment/Due to constraints

		residents' knowledge retention of assessment, diagnosis, and treatment procedures, as well as learning experience, of patients with spinal trauma after training with a virtual patient case or a video recorded traditional lecture.		medical students and orthopedic residents in Sweden that volunteered and were randomly assigned to a group. N=170	d family member and physician and a high fidelity sim man. Able to assessment patient, talk to family member and report to the standard physician their findings. Ended with feedback. Lasted 45 minutes. IV2 Video recorded traditional lecture 13 minute recorded lecture that filmed the PowerPoint and presenter. Followed by discussion of the topic. DV1 Long-term knowledge retention related to assessment, diagnosis, and treatment of trauma cases DV2 Educational benefits if virtual learning versus traditional lecture by	least 2 months after the intervention. DV2 Questionairre filled out immediately after the first test. Asked about attitudes and perceptions of the learning experience. Four close ended questions used a Likert scale about IT experience and proficiency and 15 close ended questions used a Likert scale about current cognitive and affective states. Two additional questions for virtual group. Six questions on general opinion and perceptions of the learning experience using a Likert scale. RM-ANOVA for test scores	patient when compared to a recorded lecture. Both groups had a small knowledge decline in test 2 when compared to test 1 ($p>.05$), and there was no difference in test 2 scores between groups ($p>.05$). Learning experience was no different between the groups either. However, participants were more engaged with the virtual patient format based on the open ended question responses.	knowledge gain from test 1 to test 2 could be monitored, Test 2 done online with no control of use of external aids, only used one patient case This is a feasible study as one could easily replicate the format used by the authors and is cost effective. While there was no difference in knowledge gain, participants self-reported higher levels of engagement with the virtual patients. I recommend further study using more than one patient case scenario as this may show the virtual method has a bigger impact on knowledge gain.

					looking at participants self-reported learning experiences.			
7.	Ding, M. (2016).	To review the current literature on trauma nursing education	Whitmore and Knaff theoretical framework for integrative review.	Integrative literature review Design sample and setting NA	160 full text studies included in review. Only 17 studies; 9 quantitative ,7 qualitative, and 1 review, met inclusion criteria.	NA	There is a shortage of studies that evaluate the effectiveness of trauma nursing courses on patient outcomes. Very limited literature that evaluates trauma nursing education, however one study found poor knowledge retention at 3 months post intervention and recommends refresher training.	I Use of Bowling's and Pearson's validated appraisal checklists, used only peer reviewed articles, clear inclusion criteria, 2 stages of review during article selection, gray literature search, clear documentation of exclusion criteria, use of a PRISMA flow chart, majority are quantitative methods, use of Australian NHMRAC Evidence Hierarchy/Limited studies on the topic, no mixed method studies were found, no confirmation by a second person to ensure accuracy An integrative review is a feasible design; however, it can be time consuming. This study demonstrates the lack of literature on trauma nursing education and evaluation of trauma courses. This is the reason my DNP project is focused on trauma nursing education. This study further supports my recommendation on the need for more research on trauma nursing education.

8.	Garvey, P. (2016)	To assess the effectiveness of the Trauma Tactics course.	None mentioned.	Retrospective descriptive study. Nurses who previously participated in the Trauma Tactics Course that completed all the required study documents. N=55	IV Trauma Tactics Course DV1 Knowledge gain measured with pre- and post-tests DV2 Perceived confidence measured with a survey pre- and post-course DV3 Ability to perform a trauma assessment in a clinically simulated environment measured with assessm	DV1 20 multiple choice question test scores pre and post course DV2 6 question survey using a 5 point Likert scale pre and post-course DV3 simulation assessment scores after sim zero and sim final Mean, median, mode, range, % increase	The Trauma Tactics course demonstrated improvement in learners comfort levels with a percent increase ranging from 11.8% to 42.7%. There was a mean of 16.5 on the pre-test and 19 on the post-test for knowledge. 80% of learners experienced an increase in test scores pre to post-test. The average increase in scores was 3.3 points. For simulation performance there as a mean of 10.22 for sim zero and 26.25 for sim final. 100% of learners had an increase in test scores pre to post-test with an average increase of 16 points in simulation scores.	III retrospective design that only included those who completed all of the study documents/small sample size, single center, retrospective design, lack of statistical analysis to demonstrate study effects. This is a feasible study to replicate, however a 2 day course could impact staffing levels and reduce the number of people able to participate. Use of the trauma tactics course using simulation and lecture positively impacted knowledge gain, simulation performance and comfort levels of nurses caring for trauma patients. I recommend this study be replicated as a prospective design. Use of a comparison method, such as lecture only, could further strengthen the trauma tactics course effectiveness.
9.	Haley, K. (2017).	To discuss a novel process of identifying and establishing standardized trauma nurses care objectives for ACS-verified trauma centers in	None mentioned.	Modified Delphi and the Delphi method. Seven regional trauma centers in central, eastern, and southern Ohio	42 objectives were sent to the committee. Modified Delphi was used to narrow it down to 5 objectives. The Delphi method was used on the 5 objectives with 3 final	NA	Forty-two trauma nursing educational objectives were identified. That list was narrowed to three objectives that serve as the framework for regional educational guidelines for trauma nursing.	VIII Use of the Delphi and modified Delphi method, inclusion of the timeline of events and what occurred at each step, mention that standardized courses such as TNCC meet their objectives, did a gap analysis/they mention a pathway to implement the objectives was developed but they

		central, eastern, and southern Ohio, and members of the Central Ohio Trauma System.			objectives identified			do not share it in the article This is a feasible study as long as other centers wish to participate. Developing specific objectives for trauma education for the state trauma centers can standardize trauma education and help identify gaps in the system. I recommend this article to address trauma nursing education. There are very few standardized trauma nursing courses available, so education varies greatly.
10.	Johnson, M.P. (2014).	To compare the levels of knowledge, attitudes, and skills related to managing critically ill patients between advanced practice nursing students.	None mentioned	Quasi-experimental pre-post-test design. Convenience sample of graduate nursing students over 3 semesters prior to starting clinical rotations. N=32 (ACNP 27, CRNA= 5)	IV1 Maniken training-used SimMan 3G and SimMan Essentials. IV2 Web-based training-DXR Clinician a web-based software-training program that is interactive. Students were able to, interview, examine, diagnose, and treat patients. DV1 Knowledge Questionnaire modeled after one	IV2 time and action for each student response was logged by the software. DV1 Brief self-assessment questionnaire pre and post training. Scores could range from 4-20 DV2 Brief self-assessment questionnaire pre and post training. Scores could range from 5-25 DV3 Brief self-assessment questionnaire pre and post training. Scores could range from 9-45. Performance checklists pre-post training used by independent raters modeled after ones used by Steadman, Schwartz, and Morgan. Each	Comparing pre to post training, both groups had significant improvements (maniken p <.001, web p<.001, self-assessed knowledge p<.02). There was statistically significant improvement in scores on self-assessment in the maniken group (p=.001). The maniken group also scored significantly higher than the web group in observed performance scores (p=.02).	III Blinding of trainers and evaluators, interdisciplinary team of experts used as consultants during study design and as course faculty/small sample size, single setting, varied levels of previous nursing experience, This is a feasible study as long as one has access to sim manikens and the web-based software. They are costly and could be a barrier to implementation. Simulation and web-based training were effective in improving observed performance skills. The maniken group performed better on the self-assessment and observed performance mean scores. So, while both methods are

					done by Weller. 4 questions for knowledge DV2 Attitudes Questionnaire modeled after one done by Weller. 5 questions for attitudes DV3 Skills Questionnaire modeled after one done by Weller. 9 questions for skills Performance checklist used by independent raters modeled after ones used by Steadman, Schwartz, and Morgan. History taking 15-21 items, clinical management 12-20 items,	item had a weighted score from 0.5-3 points with possible score totals of 0-35 for each checklist of 0-140 for all four checklists combined. Descriptive data summarized. Paired sample t tests, Mann-Whitney U, regression models,		effective, the maniken training proved to be more effective than the web-based training. I recommend using both methods for training. Further study on combining the two methods may show that is a much more successful method than using just one or the other.
11.	LaCerra, C. (2019)	To analyze the effectiveness of high fidelity patient simulation (HFPS) based on life-threatening clinical	Cochrane Handbook for Systemic Reviews of Interventions, Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist, Quality	Systematic review and meta-analysis	Full texts published in English, French, Spanish, and Italian. Samples included undergraduate and post-graduate nursing students	Random Effect Model, Cohen's d, Krippendorff's alpha coefficient, 95% CI, Egger's regression, Trim and Fill, fail-safe number methods, Q-test, I^2,	HFPS had larger effect sizes for knowledge (d=0.49, 95% CI 0.17-0.81) and performance (d=0.50, 95% CI 0.19-0.81) when compared to any other teaching method	I Systemic review and meta-analysis, checked for publication bias, heterogeneity, use of models for the type of review, used 3 independent raters, only used experimental and quasi-experimental studies, tested for agreement between

		condition scenarios on undergraduate and post-graduate nursing students' learning outcomes.	Appraisal Checklist for Quantitative Intervention Studies		taking part in high fidelity patient simulation. A total of 33 articles were included			raters using Krippendorff's alpha coefficient/only a few used an experimental design, selection bias could be present in the studies used, heterogeneity present, differing levels of education, publication bias towards self-efficacy, lack of demographic data, measurement tools, session duration, and model used for debriefing limited analysis of the studies This is a feasible study for my practice but not for my DNP project. While this addresses simulation, it does not focus on trauma education. HFPS has a significantly positive impact on knowledge and performance when compared to other teaching methods. I recommend using this article as a way to address gaps in knowledge and performance related to deteriorating clinical conditions.
12.	Liaw, S.Y. (2014).	To describe the development of the virtual patient simulation and evaluate its efficacy for improving the nursing	None mentioned.	Prospective randomized controlled trial with pretest-post-test design. 97 Third year nursing students who had undertak	IV1 2-hour fully automated virtual patient simulation-single user interactive multimedia simulation created with Flash software and run on a secure server. Five	DV baseline testing using mannequin-based simulation for all subjects after randomization. Followed by interventions. Tested individually for virtual group with 5 scenarios, mannequin group were tested in groups of 6 led by trained simulation	Both groups had statistically significant improvements in both the first and second post-test ($p<.001$). The experimental group had significantly lower scores on the second post-test ($p <.05$) compared to their first test, but the control group had no significant difference between	II Subjects wore gowns, caps, and masks to blind them to raters to reduce bias, construct and content validity, and interrater reliability tested with excellent interrater reliability, video recorded all scenarios/difficult to account for differences in designs and structures of interventions, did not

		students' performances in assessing and managing patients with clinical deterioration.		en a 6 hour manneq uin based RAPID S simulation program 8 months prior were invited to participate via email. 61 consented to participate. Four lost to attrition due to scheduling issues. N=57	scenarios were used with debriefing after each one. All sessions video taped IV2 facilitator-led mannequin-based simulation DV Knowledge	facilitator through 2 scenarios with each one followed by debriefing. Both groups had 2 hours for the intervention. Virtual group completed a 19-item questionnaire using 7 point Likert Scale to evaluate learning experiences. Both groups had 2 post-tests using mannequin-based simulation assessments. First test was 1-2 days after intervention and the second test was 2.5 months later. Recorded simulation performances were observed and rated by academic staff using RAPIDS tool Correlation coefficient, Cronbach alpha, effect size, Chi-square tests, t-tests, RM-ANOVA, descriptive statistics of means and standard deviations	the two (p=.94). There were no significant differences between groups when comparing scores over time (P=.17). For the evaluation, the virtual patient simulation scored highly positive with satisfaction (mean 6.06, SD 0.56), quality of the system (mean 6.01, SD 0.71), information (mean 6.06, SD 0.50), and net benefits (mean 6.28, SD 0.59) on the 7-point Likert scale.	measure performance right after the 6 hour RAPIDS course to determine level of deterioration, same duration for each group thus experimental group had a limited time to get through 5 scenarios, small sample size, single setting, volunteered to participate. This study is feasible; however, cost could be an issue if one does not have the required software or simulation equipment. Both the experimental and control groups had significant improvement in knowledge from the first to the second post-test. Looking at test one to test two within the experimental group, test scores were significantly lower on the second test. Overall, use of virtual patients demonstrated positive effects on knowledge. My recommendation is that virtual patient simulation is another effective method for training in nurses, especially since COVID has led to restrictions in class sizes and gathering. Ideally, using it in conjunction with mannequin simulations may prove to be an even more effective teaching method

13.	Mariani, B. (2016).	To gain a better understanding of the perceived gaps in simulation research. To identify areas of research saturation and areas of the science that need further evidence	Naturalist inquiry approach	Descriptive qualitative study with naturalist inquiry approach Convenience sample of registered nurses that belong to the International Nursing Association for Clinical Simulation and Learning. N=90	IV Questionnaire with 7 structured open-ended questions and questions on demographics DV Simulation research-areas that have been well studied, gaps, obstacles to conducting research excluding funding	IV Four categories identified through content analysis DV Content placed into the categories to determine areas with the highest frequencies. Summative content analysis, objective 3rd party expert in qualitative analysis reviewed transcripts to ensure accuracy of analysis	Existing research lacks vigor, and often uses small sample sizes at single settings. Lack of collaboration between universities and hospitals, availability of valid and reliable simulation research. Time was the biggest obstacle doing research followed by lack of resources/space, lack of participants, access to conduct multi-site studies, lack of experience/mentors, faculty support, lack of standardization, and lack of leadership support. Top priorities for research were research that measures the influence of simulation on patient outcomes, measure outcomes of simulation on student learning, need for more rigorous study design with larger sample sizes, more randomization and use of valid and reliable evaluation measures at multiple sites, studies that include simulations with vulnerable populations and ones that measure the outcome of simulation on patient safety.	VII Open ended questions verified analysis with a 3rd party expert, 90 participants/Results only generalized to nursing, only focuses on members of INACSL not all of nursing, open-ended survey time of 20-30 minutes could deter participation, subjects may not fully understand simulation literature. A qualitative survey is feasible as it uses very little resources to perform the measurement. Analysis of the content can be time consuming. Rich data is obtained through the use of open-ended questions. The survey found the biggest gaps in multi-site simulation studies and studies that focus on student and/or patient outcomes. I recommend this article as it provides gaps in the current simulation literature that one can address in a study design.
14.	McCutcheon, K. (2014).	To determine whether the use of	Joanna Briggs Institute	Mixed methods systemat	Searches of 5 databases for the time period of	Critical appraisal tools from JBI-MAStARI and JBI-QARI.	10 of 13 articles reviewed found that online learning was just as effective at	I Synthesis conducted by primary reviewer and results regularly

		an online or blended learning paradigm has the potential to enhance the teaching of clinical skills in undergraduate nursing.	User Guide version 5	ic review	1995-2013. 197 articles found; 31 full texts retrieved of the 197 found. Nine were removed due to not meeting inclusion criteria. N=19 (17 on online approaches and 2 on blended approach; 14 quantitative, 3 mixed methods, 1 qualitative, 1 integrative review). Limited to English papers. Only studies using undergraduate nursing students were included.	Predetermined themes of method/research design, study aims, sample population, outcome measure and results used to abstract data.	improving clinical knowledge in nursing students. Thirteen articles found that students gained higher or similar levels of clinical skills when compared to traditional teaching methods. Five of 11 studies found students were more satisfied with online learning compared to traditional learning.	reviewed with review team, use of Joanna Briggs Institute guide for reviews, included a variety of research designs, detailed explanation of inclusion and exclusion criteria /Four studies were excluded due to being non-English papers, excluded pilot and feasibility studies, potential publication bias, quality appraisal stage did not exclude any papers, wide variation of interventions used made synthesis of data difficult, This is a feasible study to carry out. Time is the biggest barrier when undertaking a systematic review. Teaching clinical skills using online methods was just as effective as traditional methods. While online teaching is an effective method, one is unable to assess the learner's comprehension of the skill in a real life situation. I recommend online teaching as an adjunct method for teaching clinical skills.
15.	Connell, C.J. 2016.	To identify the evidence supporting educational effectiven	None mentioned	Mixed-methods systematic review	Initial search 6908 results. Peer reviewed, English language, 2002-2014.	None mentioned in article.	20 quantitative studies, 2 mixed methods studies, and 1 qualitative study. Effectiveness of the education was measured based on three outcomes, learner, patient, and	I Systematic review/Only one RCT, most of the studies were level III or below, potential for sample contamination, possible publication

		ess in the recognition and management of the deteriorating patient and outcome measures used to evaluate educational effectiveness.			Duplicates removed. 794 results. After review 47 studies were chosen. Inclusion/exclusion criteria reapplied. Final N=23		system. 19 studies measured learner outcomes related to knowledge and/or performance. Nine measured learner outcomes related to confidence, communication, leadership, and/or teamwork. Only 2 studies focused on retention of skills or knowledge. Four studies measured impact on patient care. Most of the educational methods reviewed showed a positive impact on the learner, patients, and organizational outcomes.	bias, reporting bias, small sample sizes, some studies may have unreliable statistical evidence This is a feasible study to conduct as it is lost cost and does not require many people to be involved. Simulation has a positive impact on recognition and management of deteriorating patients with high fidelity simulations having more benefits than low fidelity simulations. I recommend this article as it provides a synthesis of information related to the use of simulation and its impact on recognizing a patient's declining condition.
16.	Liaw, S.Y. 2016	To evaluate the impact of web-based simulation on nurses' recognition of and response to deteriorating patients in clinical settings.	Kirkpatrick's hierarchy of educational outcomes, Keller's Model of motivational design	Pre/post intervention study One surgical and one medical ward at an acute care tertiary teaching hospital in Singapore. All nurses working the 2 wards were scheduled to take the course.	IV e-RAPIDS course a web-based simulation using a virtual patient developed by a multidisciplinary health care team. DV1 Knowledge pre- and post-test scores on 30 item Multiple choice question test (MCQ) DV2 Motivational Reaction	DV1 30 item MCQ developed to align with program learning objectives, DV 2 5 point Likert Scale survey immediately after e-RAPIDS course DV3 Self-reported questionnaire using 5 point Likert Scale on their perceived training transfer at their workplace that was conducted 3-4 months after training (Cronbach alpha =.94). DV4 clinical records on cases	DV1 Both RN's and EN's had a significant improvement on post-test scores ($p<.001$) compared to pre-test scores. DV 2 IMMS mean scores indicated nurses were motivated to learn (mean 3.78, SD 0.56). e-RAPIDS was also perceived to be more stimulating in capturing nurse's attention (mean 4.06, SD .52) as well as building more confidence (mean 3.83, SD 0.44). RNs scored significantly higher than the ENs overall ($p<.001$).	III e-RAPIDS was validated in a previous study, content validity established by panel of medical and surgical care experts, reporting of Cronbach alphas for the IMMS and the questionnaire /lack of a control group, vast difference between the 2 units, short time period for clinical triggers data, small sample size, single center This is a feasible study to conduct if one can get permission to use the e-RAPIDS course the authors developed. Otherwise, the

				64 RNs and 35 enrolled nurses (EN), N=99 with an attrition of 16 for a final N=83 (58 RN, 25 EN)	completion of the Instructional Material Motivation Survey (IMMS) DV3 Training Transfer at workplace DV4 Change in organizational practice	triggered by nurses from the study were checked by investigator for frequency and types of triggers over 6 months pre- and post-intervention. Cronbach alpha, descriptive statistics using means, standard deviations, counts, and percentages, paired t test, independent sample t-test, Chi-squared test, Fisher's exact test	DV3 All nurses had positive attitudes toward transfer of learning (mean 3.82, SD 0.52) but there was no significant difference between RNs and ENs. DV4 There was a significant increase ($p < .001$) in the number of cases triggered by nurses on the medical ward from pre-intervention to post-intervention. There was no difference in the surgical unit ($p = .15$).	content of the training may vary and not support the findings of this study. Nurses were more motivated and stimulated to learn, gained more confidence and knowledge with the e-RAPIDS course. Nurses also found that the training transferred to their workplace and changed their practice. I recommend replicating this study to further support the findings but using a control group and like units to limit the variations in patients. I would also recommend looking at triggers for a longer time period.
17.	Brydges, R. 2015.	To examine the evidence supporting the use of simulation-based assessments as surrogates for patient-related outcomes assessed in the workplace.	PRISMA standards, Messick's framework, Medical Education Research Study Quality Instrument	Systematic review and meta-analysis	11,628 potential articles, 59 studies identified. 33 met inclusion criteria.	Messick's framework, interrater reliability, Cohen's classification, z-transformed correlation coefficients, I^2,	Provider behavior pooled correlation was 0.51(95% CI 0.38-0.62), for time behaviors 0.44 (95% CI 0.15-0.66) and for patient outcomes 0.24 (95% CI -0.02-0.47).	I Validity testing only used studies that reported correlation coefficients or that could be obtained from the authors, systematic review, meta-analysis, statistical power, rigor, no evidence of publication bias/gaps in validity, did not include standardized patient simulation articles, possible noncausal associations, nonuniform response to change, incomplete representation of a task. Reviews like this are feasible but can be time consuming and difficult to perform if one is inexperienced.

								Simulation based-assessments have a positive impact on patient-related outcomes. This review supports the use of simulation as a means to improve patient outcomes. I recommend further studies on the topic that address the gaps the authors found.
18.	Kelsey, N.C. 2016.	To determine the effect of in situ simulation during the course of a typical day on the ability to rescue.	None mentioned.	Quality improvement study All RNs, LPNs, and unlicensed assistive personnel on a regular inpatient medical-surgical unit over a 12 hour shift.	IV In situ simulation is a scenario using a standardized patient that took place on the nursing unit over a 12 hour shift. Nurses were instructed to have 3 separate encounters during the shift. No interventions were actually performed, they were verbalized. At the end of the encounter nurses were asked to make a decision on care and discuss causes for symptoms. Debriefing occurred at the end of	V Evaluation on experience, learning, facilitation methods, and relevance using a 5 point Likert Scale. DV Pre/post surveys on 4 themes (knowledge and comfort with SCI, neurological assessment, activation of rapid response, and escalation of the chain of command) scored with 5 point Likert Scale Percentages	Only 45% could identify that the symptoms were a result of the SCI. 90% could identify the problem as neurological. One nurse was able to correctly identify the level of SCI. Most nurses were not able to identify the patient changes, so they did not call for help. RNs had improved rankings with knowledge and comfort of SCI. LPNs have improvement in knowledge and comfort of SCI, neurological assessments, and activation of a rapid response. Staff were favorable of the real-time discussion and feedback from an expert, review of signs and symptoms of deterioration in SCI patients, and availability of resources.	

					each encounter. DV Ability to rescue-nurses identification and response to patient deterioration in patients with spinal cord injuries(SCI).			
19.	Yu, S. (2017).	To assess the educational needs for simulation-based training for Korean GI endoscopy nurses.	None mentioned	Cross-sectional survey design. Convenience sample of nurses from GI endoscopy units from 6 major hospitals in Korea. 251 surveys were mailed to potential participants with a final N=238 (response rate 94.8%).	IV GI nurses' society members in Korean DV Need for simulation based training related to GI nursing using a 35 item clinical competence importance-performance scale	DV A 5 point Likert Scale was used to rate importance and performance of each competence item. Descriptive statistics, exploratory factor analysis, principal component analysis, varimax rotation, paired t-test, Bartlett's test of sphericity, Kaiser-Meyer-Olkin value,	The highest mean for importance items on the survey was for performing CPR (4.87 ±.37) and the lowest mean was for participating in research (3.81 ±.71). For performance items, the highest mean was for performing preventative measures for falls (4.95 ±.33) and the lowest was for performing CPR 1.67 ±.72). Overall, there was a significant difference between importance and performance mean scores (p<.001). The largest differences were in the mean for emergency care (p <.001) and the smallest difference was in infection control (p<.001).	VI High response rate, power analysis estimated sample of 209 and the authors had a sample of 238 so study was adequately powered/Self-reported data, single site, one country This is a feasible study as it is a survey and easy to administer. The biggest barrier in surveys is getting a large enough response rate. For GI nurses, simulations related to emergency care ranked the highest area to focus on to improve patient care and safety. This study needs to be replicated in the US in order to generalize the results to populations here as training and patient care may differ in Korea.
20.	Kaufman, E.J.	To determine the impact of obesity on	None mentioned	Retrospective cohort study	IV obesity DV failure to rescue defined as death after	ISS, MOI, physiology, comorbidities, FTR events,	The study found that obesity was not a predictor of risk for FTR, however obese patients were more	III Large sample size, 30 sites involved, use of trauma registry/variations in

		outcomes, such as failure to rescue, after traumatic injury and major surgery		30 level I and II PA trauma centers. 95,806 patient charts were included with 15,253 of those being obese patients.	a complication.	patient demographics Risks regressions, multivariable logistic regression, chi-squared, Mann-Whitney, t-test	likely to have complications such as infections or respiratory decline. The higher risk of complications places the obese patient at risk for FTR, however, Kaufman et al. (2020), felt that their facility must manage these complications well since there was no difference in FTR between the non-obese and the obese. 42% of obese patients had at least 1 complication and 28.7% had at least two. The most common complication was pneumonia (p=.003) followed by sepsis (p=<0.001) and DVT (p<0.001). Obesity was associated with complications (95% CI 1.2-1.6).	obesity classification, did not look at type of procedures done in the OR, registry may have misclassified data. While obesity did not impact FTR, it did have a correlation with complications after trauma surgery, such as pneumonia and sepsis. This is very relevant to trauma practice. Obesity is a national epidemic so all trauma centers will be caring for these patients. Being aware of the risks these patients face will help providers give better care.
21.	Rice, Y. (2016).	To determine if the program would improve knowledge, satisfaction, self-confidence, and simulated team performance.	None mentioned	Pre-post-test design Level I trauma center. Convenience sample of 7 nurses with BSNs, 21 years old and with less than 2 years of ICU and nursing experience.	IV simulation-learning environment that allows for hands on education without risk to patients. DV1 knowledge DV2 satisfaction DV3 self-confidence DV4 simulated team performance	DV 2& 3 Student Satisfaction and Self-Confidence in Learning Survey DV4 TTPOT and T-TAQ Descriptive statistics, paired t-tests, means	Simulations helped improve team structure (p=.0001) and communication (p=.009). Observed scores for situation monitoring (p=0.000), mutual support (p=.000), and communication (p=.001) improved as well. Overall, participants were satisfied (mean 21.5 of a total 25). Self-confidence was rated high as well with a mean of 38.83 of 40 possible points. Attitudes of mutual support (p=0.04) and communication	III Use of multiple validated tools/small sample size, single center, convenience sample This is a feasible study as it is very similar to my DNP project. Simulation for training trauma ICU nurses improved participants attitudes, perceptions, and performance of teamwork, and participants found the course improved their self-confidence in trauma care. I recommend this study to those

							(p=.001) were decreased after simulation.	working in trauma; however, the study needs to be replicated to further support the findings as the sample size was only seven nurses.
22.	Sharoky, C.E. (2019	To validate single-site findings of the location and timing of FTR events using a statewide trauma registry.	None mentioned. 30 Level I and II PA trauma centers. Patients >16yrs with a minimum AIS of 2 or higher. A total of 15,388 patients were reviewed.	Retrospective observational study	IV FTR defined as death after a complication. DV1 location where patient was in their stay when FTR occurred. DV2 timing, how far patient was into their hospital stay when the FTR event occurred.	DV1 & 2 time and unit were abstracted from charts. Descriptive statistics, Kruskal-Wallis, chi-squared, Mann-Whitney,	Median age of FTR was 58 (P<0.001). Most had suffered blunt trauma (89%) and had a higher injury burden (p<.0001). The highest number of inpatient FTR cases occurred in the ICU (63%) when compared to other hospital units. Respiratory and cardiac issues were the two most common complications leading to FTR. Death, or FTR, typically occurred early in the hospital course, usually in the ED or OR (p<0.0001).	III Large sample size, 30 sites involved, use of trauma registry/retrospective design, use of registry that could have data entry errors, does not include death after discharge Patients who experienced FTR were more likely to do so early in their hospital stay while in the ICU. This is a relevant study and can help trauma programs focus efforts to prevent FTR at the time and location with the population most at risk which could improve patient outcomes.
23.	Hustad, J.(2019).	To explore nursing students' experiences of simulation-based training and how the students perceived the transfer	None mentioned.	Qualitative descriptive design, Focus group interviews Purposive sampling was used. 32 student nurses at a Norwegian University	IV Simulation-one week program done before entering clinical practice DV Transfer of learning interview guide using 3 open-ended questions	Eight focus group interviews were done. Transcribed interviews were analyzed by the authors using Braun and Clarke's six step-by-stp guide for thematic analysis. Initial codes were developed then the first author read the material searching for themes. Then all authors searched for themes and related them to the codes. Authors met several times to	Simulation was shown to improve self-confidence, clinical skills and judgement, and emphasis the importance of communication and team collaboration. Students felt the simulations mentally prepared them for clinical by bridging the gap from theory to practice. They also found that the simulations made them more aware of how importance an assessment with vital signs is. Use of	II Open-ended questions/small sample size, single center, volunteered This is a feasible study design and one that can be quite useful in determining the value of an educational program to the student. Overall, simulations not only improved students' self-confidence, it also helped them put into practice what they had only learned in books. Thus making them more prepared

				volunteered.		discuss findings, revise, define, and name themes. Descriptive statistics, percentages, thematic analysis,	closed loop communication and SBAR was found to be an important part of student communication after taking part in the simulations.	to enter their clinical rotations.
24.	Parihk et al., 2022	To evaluate if simulation-based education and debriefing using a CPR feedback device would improve CPR performance on an infant manikan in NICU nurses.	None mentioned	Single center prospective, observational simulation study. 62 NICU nurses at the Children's Hospital of San Antonio, TX	IV simulation based education and debriefing DV1 chest compression rate, depth, fraction, and recoil DV2 confidence level	Chi squared for categorical variables. Variables without normal distribution were reported in median with IQR. Median and IQR were done for depth, rate, fraction, and recoil. Paired t-test for pre and post debriefing depth, rate, fraction, and recoil. Wilcoxon rank sum test compared pre and post simulation confidence levels. Significance was set at $p < 0.5$.	Significant improvement in depth and fraction but no difference in rate and recoil. Significantly higher confidence levels in all CPR dynamics when comparing pre to post simulation and debriefing.	Weakness: No comparison group to determine if the simulation and debrief was the main reason for the skill and confidence improvements. Small sample size, single center, lack of real time feedback on performance. Confidence survey was not a validated tool. Strengths: Two independent reviewers with a moderator to resolve any disputes in scoring. Followed NRP/PALS guidelines. Use of CPR feedback device for objective measurement. Simulation can be an effective way to improve skill competence and learner confidence.
25.	Karatas & Tuzer, 2020	To investigate the effect of training using a standardized patient on the self-confidence and satisfaction of the	None mentioned	Sem-experimental design. University nursing students in Turkey taking the surgical diseases	IV standardized patient simulations DV1 self-confidence DV2 satisfaction	Shapiro Wilk test evaluated if the variables had normal distribution. Number and percentage values were presented for frequency distributions. Mean, standard deviation, and other descriptive statistics used for	Post-test scores significantly higher (p ,0.05) than the pre-test and the students' self-confidence and satisfaction scores had a significant relationship ($p < 0.05$)	Weakness: There was no comparison group to determine if the effects seen were a direct result of the IV. Lack of formal debrief model. Strengths: Used the NLN's validated tool Student Satisfaction and Self-confidence Scale in Learning, the knowledge test,

		students when caring for a patient under contact isolation.		in nursing course spring semester of 206-2017 academic year. Of 125 students ,30 took part in the study.		distribution of scores. Pearson's Correlation Coefficient evaluated the correlation between normally distributed variables. Significance was set at a $p<0.05$ The power analysis used a 95% CI, 84% theoretical power and 0.5 effect size.		debriefing forms, and student evaluation guidelines were based on current literature/evidenced-based practice and corrections were made for content validity based on recommendations of three content experts. Data collection tools were evaluated by a measurement and evaluation specialist. Training using simulations, standardized patients, debriefing significantly improved student's knowledge, self-confidence and satisfaction.
26.	Jyoti et al., 2021	Evaluate the effectiveness of simulation-based training vs. traditional method of teaching on the retention of birthing care knowledge and skills.	None mentioned.	Quantitative approach with comparative research design. 77 BSN 4th year students From SGT University Gurugram and R.R. College of Nursing Gururgram	IV simulation-based training DV traditional method DV2 knowledge DV3 skills	Descriptive and inferential statistics were used with significance set at a $p <0.05$	Simulation group had significantly higher scores for both knowledge and skills than the traditional method group when teaching birth care to nursing students.	Weakness: No mention of study limitations. Data analysis could have been more robust. Literature review was very minimal. Experimental group was tested 2 days before control group, so there could have been sharing of information between groups which would have skewed the results. Strength: Structured knowledge test and checklist were done by self-administration and observation. Reliability of the tools was determined using Karl Pearson's coefficient of correlation method. It was found to be 0.77 Simulation was a superior in improving knowledge and skills

								when compared to traditional educational methods. Provided new knowledge related to the use of the nursing process as a simulation framework. Overall, there was no difference between the two groups except in neonatal diagnosis and evaluation, and maternal care diagnosis. However, this study presented a new way to use the nursing process as a framework for simulation-based training. Further study is warranted in broader groups of nursing care.
27.	Kim & Shin, 2016	To identify the effects of nursing process-based simulation on knowledge, attitudes, and skills for maternal and child emergency nursing care in clinical nurses in South Korea.	Nursing Process	Equivalent control group pre- and post-test experimental design 49 nurses from the Korean Nurses Association and the Seoul Nurses Association of Korea.	IV nursing process-based simulation training program for high-risk maternal and child emergency care DV1 Knowledge DV2 attitudes DV3 emergency care skills	Percentages, Chi squared test, Fisher's exact test, t-test.	There was no difference on all pre-test measures between the control and experimental groups. The experimental group showed statistically significant improvement in all areas of knowledge, skills, and attitudes from pre to post test. The control group did just as well except in the areas of diagnosis and evaluation in the area of neonatal emergency care, and diagnosis in the maternal emergency care areas.	Weakness: small sample size, Strengths: use of a control group, study instrument had the content validity tested by to physicians and two head nurses from a NICU, two physicians and two head nurses working in the delivery room, one nursing professor who teaches maternal and child nursing, one nursing professor who teaches pediatrics, and one simulation expert. Cronbach alpha coefficient ranked .73-.75. Same for the knowledge test, attitude questionnaire, and skills checklist, which Cronbach alpha coefficient

								ranked at .80, .81, and .84 respectively.
28.	Kahraman et al., 2019	To examine the effect of training given to nursing students using simulation and standard child mannequins on their childhood epileptic seizure management knowledge, skills, and attitudes.		Quasi-experimental, randomized controlled study with a pre-test/post-test design. 80 third year students enrolled in the Child Health and Diseases Nursing Program in the 2017-2018 academic year.	IV simulation mannequins DV1 standard child mannequins DV2 epilepsy and epileptic seizure management knowledge DV2 epilepsy knowledge and attitudes DV3 epileptic seizure management skills	Mean, standard deviation, median, minimum, and maximum values for numerical data. Frequency and ration values for categorical data. McNemar's test. RM-ANOVA, t-test, Pearson's correlation coefficient, and Pearson's chi-squared.	Both groups had statistically significant ($p < 0.001$) improvement in the knowledge test from pre to post but there was not significance between the groups ($p=0.829$). For attitudes the experimental group had significant improvement ($p=.008$) when compared to the control group from pre to post test. Within groups, there was significant increase in confidence ($p=0.000$) from pre to post test.	Weakness: No mention of the validity of the knowledge and attitude scale by Aydemir et al. or the skills list by Gozen et al. that was used. No mention of who or how the simulation scenarios were developed. The skills are not reported in the results section with numerical data. All data is reported in a table. There is no breakout of control vs experimental in the table as well. Strengths: Experiment design is higher level of evidence. Had a comparison group. Both methods had a positive effect on knowledge gain, however, the simulation mannequin group had a significant improvement in attitudes/confidence in caring for an epileptic patient that the group using a standard mannequin. Therefore, simulation mannequins are a more effective method for improving attitudes and confidence in nurses.
29.	Hsu, Chang, & Hsieh, 2015	To compare the effect of a traditional course vs scenario-	None mentioned	RCT adopted with a pre-test and two post-tests	IV scenario-based simulation training	Descriptive statistics, Mann-Whitney U, Pearson chi squared test, Fisher's exact	Communication and self-efficacy scores were significantly improved (t63) in the experimental group than the control group (t51).	Weakness: sample size did not meet power, lack of reliability of assessment tools, single center study.

		based simulation training on nurses' communication training in early stages of nursing career.		Convenience sample at a medical center in Taipei City, Taiwan. Nurses on the clnical ladder, willing to take part, and involved in direct patient care. Pre n=116 post n=78	DV1 traditional training DV2 communication DV3 self-efficacy	test. ANCOVA, t-test, paired t-test,	The same was found for self-efficacy with a t (63) for the experimental group and t (51) for the control. Independent raters and nurses found the simulations to be more effective while the standardized patients found no difference in communication between the two groups. The average communication competency scores were significantly higher (t66.13) than the control. The same was found for the self-efficacy scores. Mean global ratings had no statistical difference between groups or with the standard patients.	There is no mention if interrater reliability was established between the independent raters and standardized patients. Strength: study design, Cronbach's alpha was determined for all the measurement tools. Simulation-based training has positive effect on nursing communication and self-efficacy when compared to traditional training methods. While not all areas studied showed significant improvement, simulation seemed to be more effective and enhanced the learning experience.
30.	Hegland, Aarlie, Stromme, & Jamtvedt, 2017	To evaluate the effect of simulation-based trainig on nurses' skills and knowledge	Cochrane Collaboration Risk of Bias Tool. Guideline development tool	Systematic review and meta-analysis, RCT studies 15 studies were included	Had to be a RCT study evaluation effects of simulation-based training for graduated nurses or graduated nurses in continuing education. Skills and/or knowledge had to be the primary outcomes. Had to be in English, German, Norwegian, Swedish, or Danish.	Quantitative synthesis using meta-analysis, narrative synthesis if meta-analysis was not possible. Standardized mean difference, Risk ratio, 95% CI, I^2 statistics, p-value	Simulation-based training had a positive impact ($p<0.0007$) on skills when compared to other learning methods. Knowledge had no significant difference between groups (CI -2.28 to -1.08). Comparison of methods was inconclusive. High fidelity simulation was more effective ($p<0.0001$) than CD-rom. The remaining results were all inconclusive and the quality of evidence was low grade for all areas reviewed.	Weakness: low quality grading of evidence so confidence in findings is low. Narrow inclusion criteria, potential bias from authors Strengths: systematic review and meta-analysis, used of validated tools to reduce bias and grade quality of evidence, literature search process very thorough The review found no clear result due to low grade of the evidence and mostly inconclusive information. However, simulations tend to be a

								significantly more effective training method for most areas of nursing education.
31.	Said et al., 2021	Evaluation of simulation effects on maternity nurses' knowledge, practice, and self-efficacy during management of eclamptic fits	None mentioned	Quasi-experimental Obstetrics and Gynecology department at Benha Teaching Hospital. Convenience sample of 40 nurses from the OBGYN dept.	IV simulation DV1 Knowledge DV2 practice DV3 self-efficacy	Descriptive statistics, paired t-test, chi-squared, Pearson correlation coefficients,	Significant ($p<0.001$) improvement in knowledge when comparing pre to post and 8-week post intervention for side effects of mag sulfate, symptoms of mag sulfate toxicity, antidote use for mag sulfate toxicity, and respiratory decline. There is significant improvement for maintenance dosing of mag sulfate pre to immediate post ($p<0.05$) and for initial dose of mag sulfate and deep tendon reflexes between pre to 8 weeks post ($p<0.05$). Practice and self-efficacy had a highly positive correlation at immediate post and 8 weeks post, as well as knowledge and self-efficacy at the 8 week post, and self-efficacy and practice at immediate post and 8 weeks post.	Weakness: observational checklists does not mention how or what the checklist included, does not mention the validity of the self-efficacy scale used by Christian and Krumwiede, single center, small sample size, narrow focus of OBGYN nurses Strengths: study design, used self-efficacy scale by Christian and Krumwiede, assessed Cronbach's alpha on the tools used, knowledge 0.856, practice 0.869, and self-efficacy 0.879. Piloted the tools prior to the study implementation. Simulation is an effective teaching method that improves the learner's knowledge retention, practice level, and self-efficacy related to eclamptic fits in the pregnant patient.
32.	Orsi et al., 2020	To evaluate factors associated with anxiety and the effect of simulation-based	None mentioned	Longitudinal observational study with 4th year medical students during	IV simulation DV1 anxiety DV2 self-confidence DV3 learning satisfaction	Student t-test, Pearson correlation coefficient, Cronbach's alpha	Students were more anxious about the pelvic exam than the breast exam ($p<0.001$). Females were worried about hurting the patient whereas males were anxious because they would make	Weakness: small sample size, single center, no comparison group, methods not very robust Strength: Determined internal consistency of the assessment

		training on student anxiety, self-confidence, and learning satisfaction in relation to pelvic and breast examination.		their OB/GYN clerkship at a University in Brazil. n=80			the patient uncomfortable and because they had never done a pelvic or breast exam before. Both scores for pelvic and breast exam anxiety dropped significantly ($p<0.001$) from pre to post. Students had significant improvement in self-confidence and satisfaction from pre to post as well.	tools used to measure outcomes and showed good reliability and internal consistency in all the domains being tested. Simulation-based training helps lower learners anxiety while improving their self-confidence and satisfaction when performing pelvic and breast exams.
33.	Harvey, et al., 2019	To explore whether additional improvements are observed with advanced trauma training in comparison with prior interprofessional teamwork studies conducted in the same setting.	TeamSTEPPS model	Prospective, quasi-experimental pre/posttest intervention design, ACS verified Level I trauma center. Convenience sample of nurses attending the trauma academy and general surgery and emergency medicine resident practicing on trauma during the study	IV Trauma academy including simulation DV1 Knowledge DV2 teamwork perceptions DV3 team performance	Means, standard deviations, and ranges. Paired t-tests, two factor ANOVA, ANOVA, descriptive statistics, chi-squared, nonparametric Kruskal-Wallis test	Confidence scores of trauma nurses improved significantly ($p<0.001$). There was no difference between the nurse group and resident group or within groups over time for teamwork perceptions. For team performance, total scores were highest at 6 months post training that pre and 12 months post ($p=.0011$). There was a drop in total scores at the 12-month post period that declined below the pre intervention scores. Communication scores were significant at both 6- and 12-months post ($p=0.006$, $p=0.04$). Patient outcomes in the trauma bay were significantly improved in the areas of time to eFAST at 12 months ($p=0.0071$) compared to pre and 6 months post.	Weakness: no mention of validity of knowledge test, TNCC TNP skill assessment tool, or RN confidence survey, single center, convenience sample, raters not blinded to the study, no mention of interrater reliability being done, changes in policies, resident rotations, and high census could be confounders. Strength: study design, internal consistency reported for Brief T-TPQ and TPOT. Use of validated tools. Ongoing evaluation of tools and TeamSTEPPS model at same hospital with same group for over 6 years. Use of TeamSTEPPS as a model to train emergency nurses in trauma resuscitation utilizing high stakes simulation improves nurses self-

				period. No mention of sample size				confidence, team attitudes and team performance, however, the decline of certain studied domain at 6 months suggests that training should occur twice a year to maintain gains seen with the initial course.

Appendix B

Informed Consent Letter

You will be participating in a pilot course for nurses caring for trauma patients. You have been selected because you are a nurse caring for trauma patients at Carilion Roanoke Memorial Hospital on the Neuro-Trauma or Surgical Progressive Care Units for less than three years. The purpose of the study is to determine is simulations impact nurses' knowledge, skills, and confidence levels, and unplanned ICU admissions related to trauma patients. The study findings will then be used to determine if this course will become a trauma education orientation course for all new nurses that care for trauma patients.

The course itself will include a mix of simulations and lecture. The research study includes a 10-question test and a 13-question confidence level survey that will be emailed before and after the course and at 30, 60, and 90 days after the course. A demographic questionnaire will be sent before course attendance as well. All tests and surveys will be administered via REDCap® and will remain confidential. Completion of the survey and test should take about 20 minutes.

Please complete the survey and test as soon as you can. Your participation in taking the tests or answering the surveys is completely voluntary. You will not be penalized if you decide not to take part or if you decide to stop participating in the tests or surveys. The on-line completion of the tests and surveys is considered your consent to participate in the study.

This study has minimal to no risk to participants. Your survey will be confidential. Data related to the survey will be kept on a secure server and reported in aggregate. No identifying information will be collected.

You will not receive any direct benefit if you agree to participate. However, your participation may positively impact practice and lead to improved patient outcomes at CRMH. This information may also contribute to research so that others can learn from the experiences here at CRMH.

Federal regulations allow Carilion Clinic to release limited information about you to researchers at Carilion so that we may contact you regarding studies that might be of interest to you. We want to assure you that we will keep your information confidential.

If you are interested in learning more about the study, please contact Jennifer Bath Clinical Nurse Specialist for Trauma 540-537-1193. If you have questions about your rights as a research subject, you may contact staff at the Carilion IRB at 540-853-0728.

Appendix C

Demographic Data

1. Age (in years) _____
2. Gender

   ____Male ____Female _____Other _____Prefer Not to Answer
3. Years as a nurse _____
4. Years as a nurse in your current unit _____
5. Highest nursing degree

   ___LPN ___Diploma ___ADN ___BSN ___MSN ___DNP/PhD
6. Do you have prior experience caring for trauma patients?

   ___Yes ___No

   If yes, how many years? _____
7. Have you had previous trauma education?

   ___Yes ___No
8. Nursing Certifications

   ___PCCN ___CCRN ____TCRN ___Other

Appendix D

Trauma Boot Camp Knowledge Evaluation Tool

1. A patient has a chest tube with orders for it to be on -20 mmH2O of suction. You determine the suction rate is correct by looking at
   a. The bellows on the Atrium.
   b. The water level in the Atrium.
   c. The drainage on the Atrium.
   d. The suction cannister.

2. A patient on the Carilion bladder protocol had a scan of 300ml at 0800. What is your next action?
   a. In/out cath the patient
   b. Rescan in 2 hours
   c. Rescan in 4 hours
   d. Discontinue the protocol

3. A C3 level spinal cord injury patient has a blood pressure of 200/120, nasal congestion, and flushing above the nipple line indicating autonomic dysreflexia. Which of the following could be the cause?
   a. A bowel movement today.
   b. A bladder scan of 640ml.
   c. Turn and position every 2 hours.
   d. Head of bed greater than 45 degrees.

4. A patient with a chest tube to water seal now has a respiratory rate of 32 and absent lung sounds on the same side. What do you anticipate the doctor will order?
   a. Place the patient on oxygen
   b. Remove the chest tube
   c. Put the HOB up to 90 degrees
   d. Place the chest tube on suction

5. A traumatic brain injury patient is quite agitated despite having ruled out potential causes such as urinary retention, constipation, and pain. Which of the following may help reduce their agitation?
   a. Turning the lights off
   b. Turning the TV on
   c. Opening the blinds
   d. Using restraints

6. You are told in report that your patient with a traumatic subdural hematoma has been a GCS 15 and following commands all shift. On your exam, they are now a GCS 14 and only following commands occasionally. What is your next step?
    a. Order at CT scan of the head
    b. Continue to monitor the patient
    c. Page stroke team to see the patient
    d. Page neurosurgery to see the patient

7. A patient with rib fractures is now complaining of increased shortness of breath. You ask them to use the incentive spirometer and they only pull 500 when they were pulling 1500 a few hours ago. Lung sounds are present bilaterally but are now diminished. O2 sat is 95% on room air. What is your next step?
    a. Page the trauma team
    b. Order a chest Xray
    c. Reassess in an hour
    d. Put the patient on oxygen

8. A patient with a traumatic brain injury is on the bladder management protocol. They have had two bladder scans of <100 ml in a row. Your next step is to:
    a. Discontinue the bladder protocol.
    b. **Notify the provider of low volumes.**
    c. Insert a urinary catheter per protocol.
    d. Start doing daily in/out caths

9. A spinal cord injury patient has their urinary catheter removed. The proper bladder regimen for a spinal cord injury is to
    a. Use the bladder protocol.
    b. Straight cath every 4 hours.
    c. Bladder scan daily.
    d. Straight cath daily.

10. Which of the following is NOT part of a neuro exam?
    a. GCS
    b. AVPU
    c. Pupils
    d. CIWA

Appendix E

Confidence Evaluation Tool 1. Student Satisfaction and Self-Confidence in Learning

Instructions: This questionnaire is a series of statements about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your attitude toward your satisfaction with learning and self-confidence in obtaining the instruction you need. There are no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous with the results being compiled as a group, not individually.

Mark:
1 = STRONGLY DISAGREE with the statement
2 = DISAGREE with the statement
3 = UNDECIDED - you neither agree or disagree with the statement 4 = AGREE with the statement
5 = STRONGLY AGREE with the statement

Satisfaction with Current Learning	**SD**	**D**	**UN**	**A**	**SA**
1. The teaching methods used in this simulation were helpful and effective.	1	2	3	4	5
2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum.	1	2	3	4	5
3. I enjoyed how my instructor taught the simulation.	1	2	3	4	5
4. The teaching materials used in this simulation were motivating and helped me to learn.	1	2	3	4	5
5. The way my instructor(s) taught the simulation was suitable to the way I learn.	1	2	3	4	5
Self-confidence in Learning	**SD**	**D**	**UN**	**A**	**SA**
6. I am confident that I am mastering the content of the simulation activity that my instructors presented to me.	1	2	3	4	5
7. I am confident that this simulation covered critical content necessary for the mastery of medical surgical curriculum.	1	2	3	4	5
8. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting	1	2	3	4	5
9. My instructors used helpful resources to teach the simulation.	1	2	3	4	5
10. It is my responsibility as the student to learn what I need to know from this simulation activity.	1	2	3	4	5
11.I know how to get help when I do not understand the concepts covered in the simulation.	1	2	3	4	5
12.I know how to use simulation activities to learn critical aspects of these skills.	1	2	3	4	5
13.It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time..	1	2	3	4	5

Appendix F

Course Evaluation

Please rate **your level of satisfaction** with this training by placing a number on each line below. *Please use the scale provided.*

1	2	3	4	5
Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied

___ The course met its stated objectives.

___ The course format was effective.

___The course faculty was knowledgeable.

___ I would recommend this course to others.

As a result of this course, I am now better prepared to

___ troubleshoot a chest tube

___ use the bladder management protocol

___ perform a neurological exam

___ teach a patient to use incentive spirometry

___ document interventions and assessments in EPIC documentation

___ communicate with the team

Ideas for future training topics_____

Comments:

Appendix G

Simulation Lab Course Evaluation Tool

Course: Inpatient Trauma Bootcamp
Date: February 3, 2022
Faculty Instructor: Jen Bath
Simulation Education Facilitator: Amanda Anderson

CARILION CLINIC
Center for Simulation, Research and Patient Safety

SELF EVALUATION

BASED ON THE FOLLOWING LEARNING OBJECTIVES, PLEASE RATE YOUR CONFIDENCE LEVEL ***BEFORE*** THE SESSION TODAY:

	1 Very Low	**2 Low**	**3 Moderate**	**4 High**	**5 Very High**	**N/A Not Applicable**
Your ability to recognize deterioration in a trauma patient						
Your ability to perform relevant assessments on the deteriorating trauma patient						
Your ability to intervene appropriately for a deteriorating trauma patient based on assessment findings						
Your ability to describe the bladder management protocol and how it differs for spinal cord injury patients						

BASED ON THE FOLLOWING LEARNING OBJECTIVES, PLEASE RATE YOUR CONFIDENCE LEVEL ***AFTER*** THE SESSION TODAY:

	1 Very Low	**2 Low**	**3 Moderate**	**4 High**	**5 Very High**	**N/A Not Applicable**
Your ability to recognize deterioration in a trauma patient						
Your ability to perform relevant assessments on the deteriorating trauma patient						
Your ability to intervene appropriately for a deteriorating trauma patient based on assessment findings						

Your ability to describe the bladder management protocol and how it differs for spinal cord injury patients						
PLEASE INDICATE YOUR LEVEL OF AGREEMENT WITH THE FOLLOWING STATEMENTS REGARDING YOUR SESSION TODAY:						
SIMULATION STAFF EVALUATION						
	1 Very Low	**2 Low**	**3 Moderate**	**4 High**	**5 Very High**	**N/A Not Applicable**
I would recommend simulation training sessions to my colleagues						
Overall, I was satisfied with the service provided by the simulation center staff						
The support I received during the simulation session met my expectations						
I benefit from being able to learn in an environment in which I can make mistakes						
I feel more confident in my ability to care for real patients using the skills I learned today.						
Debriefing contributed to my learning.						
Learning at the simulation center is useful for my training/profession						
FACULTY EVALUATION						
	1 Very Low	**2 Low**	**3 Moderate**	**4 High**	**5 Very High**	**N/A Not Applicable**
The instructors were knowledgeable about the subject matter that was taught						
The instructors provided a safe, non-threatening learning environment						
The facilitator was on time and prepared for the simulation experience						

I feel more confident in providing interventions that foster patient safety.						
There was a good balance between hands on and theoretical learning						

HOW WILL THIS SESSION IMPACT THE WAY YOU WORK? PLEASE CIRCLE ALL THAT APPLY				
Communication Skills	Skill Competence	Leadership Skills	Teamwork Skills	Confidence Level

DEMOGRAPHICS

PLEASE IDENTIFY YOUR CURRENT PROFESSIONAL ROLE WITH AN X

PROFESSION	NURSE	MD/DO	PA	NP	RRT	MEDIC	RESIDENT	FELLOW	NA	XRAY	OTHER

Please explain if other:

How many years of experience do you have in your current role?	

LEVEL	**PGY1**	**PGY2**	**PGY3**	**PGY4**	**PGY5+**
If you are a resident, identify your year of training					
If you are a student indicate your current year in program					

Did today's session meet the stated learning objectives above? **YES** **NO**

What else would you like to say about today's simulation experience?

What other simulation do you think would be valuable for your learning?

Appendix H

Simulation Scenarios & Skill Evaluation Tool

Boot Camp Rib fx/IS Case **Performance Assessment Form**

Name of Rater: _____ Date of rating: ___/___/___

Rate the performance of the learner using the scale below. Place the score in the HIT column.

1 = Observed/Performed correctly
0 = Omitted/Failed to perform correctly
X = No opportunity to perform/not required during the scenario

Simulated Event	Targeted Clinical Response	Hit
BRIEF 75-year-old female fall from standing with bilateral rib fractures (left 3-5, right 4-5) with PMH of COPD, DM, and HTN. Handoff Report GCS 15 BP 143/76 HR 68 A-fib RR 22 T 97.2 oral Pox 96% on RA Incentive spirometry (IS) 1500ml Weight 62 kg Height 5'3" (64 inches) Morning assessment Pox now 88% on RA GCS 15 but restless T 100.3 oral	Assess AVPU	
	Assesses airway patency	

Simulated Event	Targeted Clinical Response	Hit

Patient alert but restless. Airway patent.		
	Assesses breathing by listening to lung sounds	
	Checks respiratory rate	
	Checks pulse oximetry	

Simulated Event	**Targeted Clinical Response**	**Hit**
Lungs sounds clear but diminished bilaterally RR 28 Pulse ox 88% on RA	Places patient on 2 L Oxygen via NC	
	Has patient deep breath and cough	
	Instructs patient on proper mechanics for IS	
	Have patient perform IS	
	Determines IS target based on patient weight.	

Simulated Event	**Targeted Clinical Response**	**Hit**
IS target=1950. IS now 500 ML. (Was 1500 ML previously)	Finds previous IS documentation in EPIC	
	Identifies significance of IS volume differences	
	Pages provider	

Simulated Event Provider does not answer page RR 32, Pox 86% on 2 L O2	Calls RRT	
	Gives SBAR report to RRT team	

Simulated Event	**Targeted Clinical Response**	**Hit**
Team performance	Team demonstrates mutual support and situational awareness during scenario.	

Simulated Event	**Targeted Clinical Response**	**Hit**
DEBRIEF Teamwork and Safety review		

	Participates in situational debrief and identifies improvement strategies.	

Total Hits ____

Notes:

Boot Camp Chest Tube Performance Assessment Form

Name of Rater: _____ Date of rating: ___/___/___

Rate the performance of the learner using the scale below. Place the score in the HIT column.

1 = Observed/Performed correctly
0 = Omitted/Failed to perform correctly
X = No opportunity to perform/not required during the scenario

Simulated Event	Targeted Clinical Response	Hit
BRIEF 58-year-old male fall from roof with left rib fractures 4-8 and a hemothorax. Handoff Report GCS 15 BP 132/58 HR 74 NSR RR 24 T 98.9 oral Pox 96% on RA Incentive spirometry (IS) 1000ml Lungs clear and equal Chest tube left chest to -20cmH2) continuous suction Morning assessment Pox now 90% on RA GCS 15 Lung sounds absent on the left, clear on the right. Asymmetrical chest wall movement.	Auscultate lung sounds	
	Assess chest tube insertion site/dressing	
	Palpate for subcutaneous emphysema	
	Check bellows	
	Check drainage chamber	
	Check for air leak/tidaling	
	Check suction dial on atrium	
	Check suction connection on atrium	
	Check suction connection on wall regulator	

Simulated Event	Targeted Clinical Response	Hit
Suction connected to atrium and wall but wall suction not turned on.	Remove tubing off the water seal to relieve the tension.	

Simulated Event Lung sounds on left now present but diminished. RR 24 Pox 96% on RA Chest tube dumps 300ml blood into chamber.		
	Pages provider regarding chest tube issue and output.	
	Provides SBAR report to team.	

Simulated Event	**Targeted Clinical Response**	**Hit**
Team performance		
	Team demonstrates mutual support and situational awareness during scenario.	

Simulated Event	**Targeted Clinical Response**	**Hit**
DEBRIEF Teamwork and Safety review		
	Participates in situational debrief and identifies improvement strategies.	

Total Hits ____

Notes:

Boot Camp TBI/Neuro **Performance Assessment Form**

Name of Rater: _____ Date of rating: ___/___/___

Rate the performance of the learner using the scale below. Place the score in the HIT column.

1 = Observed/Performed correctly
0 = Omitted/Failed to perform correctly
X = No opportunity to perform/not required during the scenario

Simulated Event	Targeted Clinical Response	Hit
BRIEF 25-year-old male, unrestrained driver of an MVC. Admitted with SDH 3 days ago. Currently on PCU floor. 0730 assessment PERRL GCS 15 and alert BP 125/67 HR 78 NSR RR 16 T 97.6 oral pOx 98% on RA 1030 NA calls nurse to go see patient because they "aren't acting right". Vitals BP 158/87 HR 98 NSR RR 24 Pox 95% on RA	Nurse assesses patient's AVPU	
	Determines patient only responsive to Pain	
	Calls RRT	
	Checks airway for patency using jaw thrust	
	Inserts oral airway.	

Simulated Event	Targeted Clinical Response	Hit
Airway is patent.	Assesses breathing by listening to lung sounds	
	Checks respiratory rate	
	Checks pulse oximetry	

Simulated Event	Targeted Clinical Response	Hit
RR 12, Pox 88% on RA Lungs clear on auscultation	Places patient on oxygen	
	Assesses circulation by checking radial pulse rate and rhythm	
	Assesses skin, color, and temp	
	Assesses IV access	

Simulated Event	Targeted Clinical Response	Hit
Patient has 1 20 g saline lock in place. Radial pulses present. HR 110 sinus tach no ectopy Skin pink, warm, and dry.	Inserts another IV and draws blood	
	Prepares IV fluids to be hung when ordered by RRT.	
	Assesses disability by checking GCS	
	Assesses disability by checking Pupils	
	Assesses disability by checking blood glucose	

Simulated Event	Targeted Clinical Response	Hit
GCS 11 (E2 V3 M6) Responds to pain, mumbles inappropriate words, following commands but not able to move left side. Pupils Left non-reactive, right sluggish.	RRT arrives	
	SBAR handoff given to RRT team.	

Simulated Event	Targeted Clinical Response	Hit
Teamwork	Team demonstrates mutual support and situational awareness during scenario.	

Simulated Event	**Targeted Clinical Response**	**Hit**
Team Performance and safety considerations		
	Participates in situational debrief and identifies improvement strategies.	

Total Hits ____

Notes:

Boot Camp SCI Bladder **Performance Assessment Form**

Name of Rater: _____ Date of rating: ___/___/___

Rate the performance of the learner using the scale below. Place the score in the HIT column.

1 = Observed/Performed correctly
0 = Omitted/Failed to perform correctly
X = No opportunity to perform/not required during the scenario

Simulated Event	**Targeted Clinical Response**	**Hit**
BRIEF 32-year-old male GSW to neck with complete SCI at C5 level. Urinary catheter removed at 0800 this morning. Orders Straight cath q 4 hours. If patient spontaneously voids, follow the bladder management protocol order set for scan volumes 1300 Patient with nasal congestion, flushing above the nipple line and BP 200/123	Nurse reviews chart for last BM and void	

Simulated Event	**Targeted Clinical Response**	**Hit**
Last BM this morning. Incontinent of urine at 1100.	Nurse performs bladder scan	

Simulated Event	**Targeted Clinical Response**	**Hit**
Bladder scan 650	Nurse straight cath's patient	

Simulated Event	**Targeted Clinical Response**	**Hit**
Straight cathed for 800 ml Patient's BP now 150/87, flushing resolved.	Nurse identifies that straight cath to be done at 1700 unless patient voids, then PVR should be done.	

Simulated Event	**Targeted Clinical Response**	**Hit**
Team performance	Team demonstrates mutual support and situational awareness during scenario.	

Simulated Event	**Targeted Clinical Response**	**Hit**
DEBRIEF Teamwork and Safety review	Participates in situational debrief and identifies improvement strategies.	

Total Hits ____

Notes:

Boot Camp Final Performance Assessment Form

Name of Rater: _____ Date of rating: ___/___/___

Rate the performance of the learner using the scale below. Place the score in the HIT column.

1 = Observed/Performed correctly
0 = Omitted/Failed to perform correctly
X = No opportunity to perform/not required during the scenario

Simulated Event	Targeted Clinical Response	Hit
BRIEF 58-year-old male MCC with left femur fracture, subdural hematoma, grade 2 splenic laceration, bilateral rib fractures, and right pneumothorax. Handoff Report GCS 15 BP 127/58 HR 68 NSR RR 22 T 98.0 oral Pox 96% on 2L O2 via NC Incentive spirometry (IS) 750 ml Lungs clear but diminished bilaterally Chest tube left chest to -20cmH20 continuous suction Two 18g IV's saline locked.	Nurse enters room for morning assessment.	
	Nurse assesses patient's AVPU	

Simulated Event	Targeted Clinical Response	Hit
Patient responds to nurse shouting his name.	Determines patient responds to verbal stimuli.	
	Checks airway for patency using jaw thrust.	

Simulated Event	Targeted Clinical Response	Hit
Airway patent.	Assesses breathing by listening to lung sounds.	
	Checks respiratory rate.	
	Checks pulse ox.	
	Assess chest tube insertion site/dressing	
	Check bellows/suction	
	Checks drainage container	

Simulated Event	Targeted Clinical Response	Hit
Lung sounds clear but decreased on the right. RR 32, Pox 88% on 2L, 300ml blood output in past hour chest tube. BP 98/50(if asks for one)	Pages trauma team/RRT	
	Increases Oxygen	
	Assesses circulation by checking radial pulse rate and rhythm	
	Assesses skin, color, and temp	
	Assesses IV access	

Simulated Event	Targeted Clinical Response	Hit
Both IV's flush without difficulty. Radial pulses weak and thready. HR 143 sinus tach no ectopy Skin pale, cool, and moist.	Prepares IV fluids to be hung when ordered.	
	Assesses disability by checking GCS	
	Assesses disability by checking Pupils	
	Assesses disability by checking blood glucose	

Simulated Event	Targeted Clinical Response	Hit
GCS 13 (E3 V4 M6) PERRL Blood glucose 187	Trauma/RRT arrives	
	SBAR handoff given to team.	

Simulated Event	Targeted Clinical Response	Hit
Team performance		
	Team demonstrates mutual support and situational awareness during scenario.	

Simulated Event	Targeted Clinical Response	Hit
DEBRIEF Teamwork and Safety review		
	Participates in situational debrief and identifies improvement strategies.	

Total Hits ____

Notes:

Appendix I

UICU Trauma Registry Data

Age

Injury Severity Score

Trauma Revised Injury Severity Score

ICU length of stay

# of ICU visits

HLOS

Ventilator days

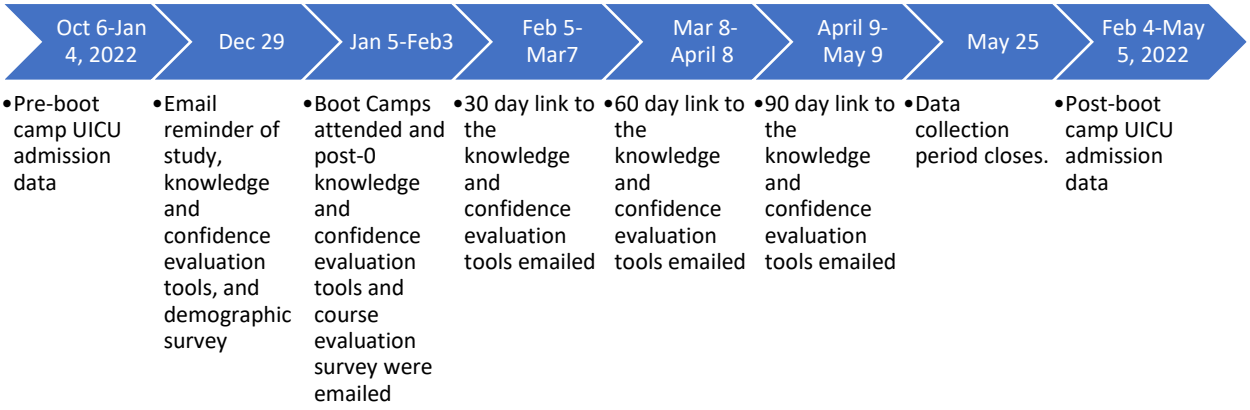
Intubated during UICU admit

Reason for UICU

Discharge status

Appendix J

Study Timeline



Appendix K

Codebook of Variables for Trauma Boot Camp Program

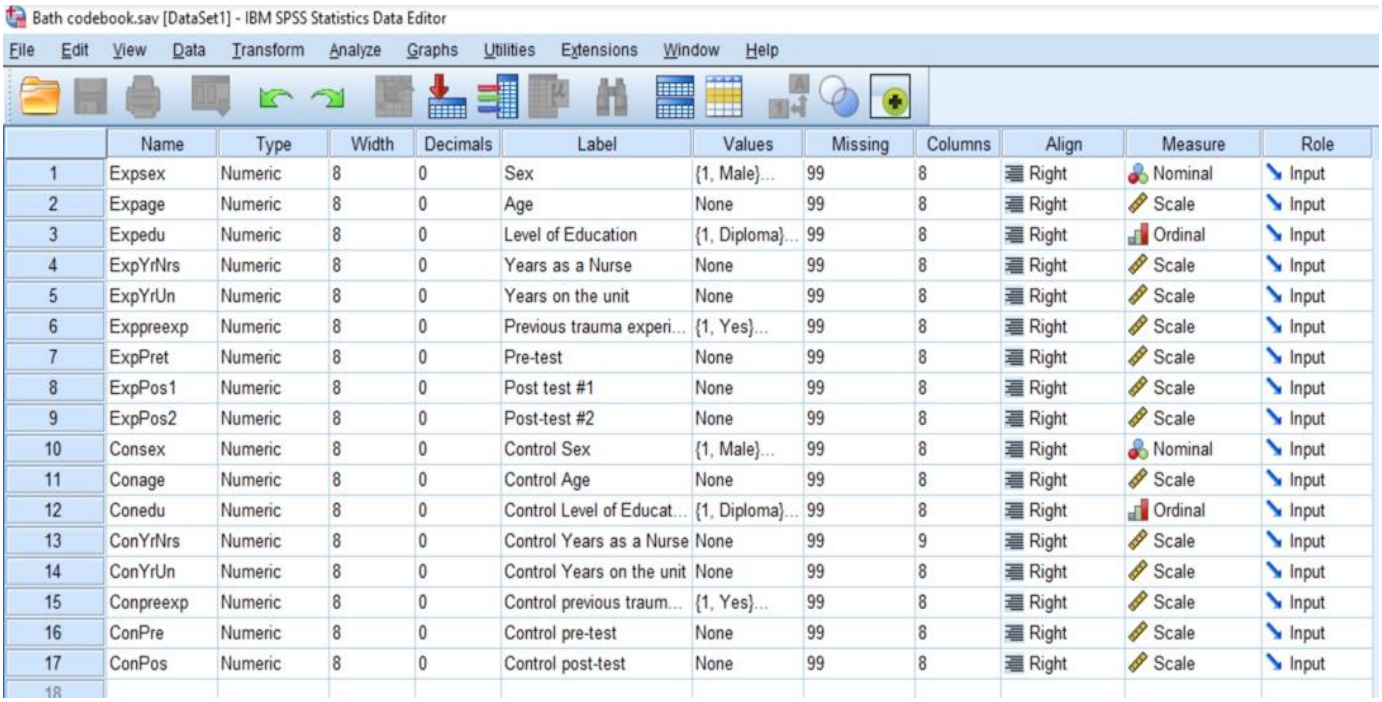
Variable Name		Variable Position in File
Expsex	Experimental group Gender Measurement Level: Nominal Column Width: 8 Alignment: Right Missing Values: 99 Value Label 1 Male 2 Female 3 Other 4 Prefer not to answer 99 Missing/Refused	1
Expage	Experimental group Respondent's age Measurement Level: Scale Column Width: 8 Alignment: Right	2
ExpeduE	Experimental group education level Measurement Level: Ordinal Column Width: 8 Alignment: Right Missing Values:99 Value Label 1 Diploma 2 Associate degree 3 Bachelor degree 4 Master degree 99 Missing	3
ExpYrNrs	Experimental group years as a nurse Measurement Level: Scale Column Width: 8 Alignment: Right	4
ExpYrUn	Experimental group years on the unit Measurement Level: Scale Column Width: 8 Alignment: Right	5
Exppreexp	Experimental group previous trauma experience Measurement Level: Scale Column Width: 8 Alignment: Right	6

ExpPre	Experimental group Pretest scores Measurement Level: Scale Column Width: 8 Alignment: Right	7
ExpPost1	Experimental group Postest 2 scores Measurement Level: Scale Column Width: 8 Alignment: Right	8
ExpPost1	Experimental group Postest 2 scores Measurement Level: Scale Column Width: 8 Alignment: Right	9
Consex	Control group gender Measurement Level: Nominal Column Width: 8 Alignment: Right Missing Values: 99 Value Label 1 Male 2 Female 3 Other 4 Prefer not to answer 99 Missing/Refused	10
Conage	Control group Respondent's age Measurement Level: Scale Column Width: 8 Alignment: Right	11
Conedu.	Experimental group education level Measurement Level: Ordinal Column Width: 8 Alignment: Right Missing Values:99 Value Label 1 Diploma 2 Associate's degree 3 Bachelor's degree 4 Master's degree 99 Missing	12
ConYrNrs	Control group years as a nurse Measurement Level: Scale Column Width: 8 Alignment: Right	13
ConYrUn	Control group years on the unit Measurement Level: Scale Column Width: 8 Alignment: Right	14

Conpreexp	Control group previous trauma experience Measurement Level: Scale Column Width: 8 Alignment: Right	15
ConPRE	Control group Pretest scores Measurement Level: Scale Column Width: 8 Alignment: Right	16
ConPos	Control group Postest scores Measurement Level: Scale Column Width: 8 Alignment: Right	17

Appendix L

SPSS Data File



Bath codebook.sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Expsex	Numeric	8	0	Sex	{1, Male}...	99	8	Right	Nominal	Input
2	Expage	Numeric	8	0	Age	None	99	8	Right	Scale	Input
3	Expedu	Numeric	8	0	Level of Education	{1, Diploma}...	99	8	Right	Ordinal	Input
4	ExpYrNrs	Numeric	8	0	Years as a Nurse	None	99	8	Right	Scale	Input
5	ExpYrUn	Numeric	8	0	Years on the unit	None	99	8	Right	Scale	Input
6	Exppreexp	Numeric	8	0	Previous trauma experi...	{1, Yes}...	99	8	Right	Scale	Input
7	ExpPret	Numeric	8	0	Pre-test	None	99	8	Right	Scale	Input
8	ExpPos1	Numeric	8	0	Post test #1	None	99	8	Right	Scale	Input
9	ExpPos2	Numeric	8	0	Post-test #2	None	99	8	Right	Scale	Input
10	Consex	Numeric	8	0	Control Sex	{1, Male}...	99	8	Right	Nominal	Input
11	Conage	Numeric	8	0	Control Age	None	99	8	Right	Scale	Input
12	Conedu	Numeric	8	0	Control Level of Educat...	{1, Diploma}...	99	8	Right	Ordinal	Input
13	ConYrNrs	Numeric	8	0	Control Years as a Nurse	None	99	9	Right	Scale	Input
14	ConYrUn	Numeric	8	0	Control Years on the unit	None	99	8	Right	Scale	Input
15	Conpreexp	Numeric	8	0	Control previous traum...	{1, Yes}...	99	8	Right	Scale	Input
16	ConPre	Numeric	8	0	Control pre-test	None	99	8	Right	Scale	Input
17	ConPos	Numeric	8	0	Control post-test	None	99	8	Right	Scale	Input
18											