ORIGINAL RESEARCH

Enhancing teamwork and clinical readiness: A collaborative simulation for BSN and DNP students in obstetric and neonatal emergencies

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ABSTRACT

Background/Objective: Simulation is utilized in nursing programs to develop critical thinking skills during a high-risk scenario in a low-risk environment. Limited research exists regarding interprofessional simulation involving graduate and undergraduate nursing students. This project aimed to explore the impact of interprofessional simulation on graduate and undergraduate nursing students, focusing on realism, role identification, collaboration, communication, delegation, teamwork, and confidence.
Methods: The sample population included 35 Student Registered Nurse Anesthetists (SRNAs) and 148 Bachelor of Science in Nursing Students (BSNs). Students participated in an Obstetric Emergency and Neonatal Emergency Simulation. Upon completion of the simulations, a survey was administered consisting of 17 questions, using a 5-point Likert scale.
Results: Survey results revealed that students strongly agreed that working in an interprofessional format enabled them to identify roles and responsibilities. Statistically significant differences were found ($p < .05$) between the BSN and SRNA students in the following areas: motivated learning, realism, identifying roles, promoting teamwork, and effective communication. A statistically significant difference was found between the students' pre-test and post-test scores, indicating that students were more confident to participate in the interprofessional simulation.
Conclusions: The results of this project support the implementation of interprofessional simulation in curriculum development to promote communication, teamwork, role identification, and confidence. Interprofessional simulations provide a safe space for students to explore delegation and role development without time constraints that could result in patient injury.

Key Words: Bachelor-prepared nursing students, Interprofessional simulation, Simulation, Student registered nurse anesthetist

1. INTRODUCTION

Simulation is utilized in nursing programs to develop critical thinking skills during a high-risk scenario in a low-risk environment. It uses advanced technology to safely recreate real scenarios and promotes critical thinking, real-time decision-making, and the innovative skills needed in the nursing profession.[1] The goals are not only to increase confidence and satisfaction, but to increase acute critical thinking skills and response time.

The term interprofessional refers to the collaboration of more than one profession.[2] This format brings together different disciplines, allowing students to participate in collaboration, communication, delegation, and role identification, thereby making the simulation more realistic. "Interpro-

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fessional simulation-based education (IP-SBE) supports the acquisition of interprofessional collaborative competencies. Psychologically safe environments are necessary to address socio-historical hierarchies and coercive practices that may occur in IP-SBE, facilitating fuller student participation".[3] A study by Dabney et al. yielded positive results, highlighting the importance of providing a safe learning environment to foster the development of leadership skills in student registered nurse anesthetists (SRNA) and collaborative approaches for effective care in critical perioperative scenarios.[4] A neonatal resuscitation team-based simulation showed positive effects on self-confidence and behavioral skills during performance of neonatal resuscitation in coordination with the care team.[5] The interprofessional format significantly alters the dynamics of a simulation.

1.1 Literature review

Interprofessional simulation is a broad topic with extensive research. A literature review was conducted using the CINAHL system, cross-referenced with Google Scholar and ChatGPT. The search was narrowed to peer-reviewed articles and texts published within the last seven years. A literature search using the terms "interprofessional simulation" and "nursing" yielded 36 articles. Narrowing the research to include undergraduate and graduate nursing students resulted in zero articles. After reviewing those articles, none included simulation with both graduate and undergraduate nursing students. These results highlight the importance of the research presented.

There are many articles that focus on interprofessional collaboration with nursing students and other medical professionals. Ferri et al. conducted a randomized controlled trial utilizing high-fidelity simulation to evaluate collaboration.[6] Their interprofessional format focused on resident anesthesia physicians and nursing students. Adams et al. conducted simulations similar to those utilized in this study, focusing on obstetric hemorrhage and a neonatal emergency, with medical students and nursing students.[7] These articles reveal that interprofessional simulation is occurring with positive outcomes; however, more research is needed to include graduate and undergraduate students, particularly nurse anesthesia students and undergraduate nursing students.

1.2 Significance and purpose

"Many adverse events experienced by patients are attributed to misunderstanding or poor communication among members of the interprofessional team".[6] Efficient teamwork could increase provider confidence, leading to fewer adverse events and, in turn, reducing costs and improving patient satisfaction and outcomes.[6] Interprofessional simulation has been utilized in healthcare training programs to highlight the importance of teamwork and communication in the delivery of high-quality patient care.[8] Although the benefits of simulation training have been widely studied across varying fields of scholarship, there is limited research on collaborative or interprofessional simulation involving graduate and undergraduate nursing students from a rural program.

This project sought to explore the impacts of interprofessional simulation, utilizing graduate and undergraduate students in a rural nursing program. Key areas of focus included realism, role identification, collaboration, communication, delegation, teamwork, and confidence. The high-risk scenarios created for this research focused on two critical patient populations: obstetric hemorrhage and neonatal resuscitation.

2. METHODS

This project was designed to evaluate the impact of interprofessional simulation on graduate and undergraduate nursing students. The sample included 183 participants: 35 SRNAs enrolled in a graduate nursing program in their fourth and ninth semesters, and 148 Bachelor of Science in Nursing (BSN) students enrolled in their second and third semesters in a graduate and undergraduate program in the Southeastern region of the United States. The nursing program in which the study was conducted is accredited by the Commission on Collegiate Nursing Education (CCNE), Council on Accreditation (COA), and the state board of nursing. The project was reviewed and approved by the Institutional Review Board (IRB) at the participating institution prior to data collection. Participation was voluntary, and no identifying information was collected to maintain confidentiality.

SRNA and BSN students participated in two interprofessional simulations that were conducted simultaneously: an Obstetric Emergency Simulation and a Neonatal Emergency Simulation. In preparation for the simulation, both groups were provided with didactic content regarding the necessary knowledge and skills to perform the simulations. Student groups had also previously demonstrated competency in assigned skills, such as intubation, neonatal resuscitation, blood administration, and administration of intramuscular injections in a lab setting. The simulation provided students and faculty with further opportunities to assess the application of knowledge in a realistic emergency situation.

Both scenarios required collaborative management of high-risk clinical situations. SRNA students assumed leadership roles within interprofessional teams, while BSN students participated in supporting nursing roles. The simulation format emphasized collaboration, communication, delegation,

and role identification across all levels of nursing education. These simulations were conducted in a controlled simulation lab made to replicate the scenarios being presented. High-fidelity maternal and neonatal patient simulators helped to create a more realistic environment.

Prior to the start of the simulation, students were given the following scenario prompt: "You are the call team taking over OB for the afternoon. Currently, there is a patient in the C-section room who just received a spinal. The patient is prepped and draped. The surgeon has made an incision." Once the patient had delivered, the mother began to hemorrhage, and the newborn was handed to the neonatal team, which prompted initiation of both the obstetric and neonatal emergency simulations.

2.1 Obstetric emergency simulation

The obstetric emergency simulated a mother undergoing a cesarean section, which resulted in a maternal hemorrhage. The care team consisted of one SRNA enrolled in the Obstetric and Pediatric Anesthesia course, faculty serving as the surgeon, two BSN students enrolled in an Adult Health Course, and two BSN students enrolled in an Obstetrics course. Management of the maternal hemorrhage was based on the 2017 guidelines of the American College of Obstetricians and Gynecologists (ACOG).[9] During this simulation, the SRNA assumed the leadership role, demonstrating delegation in an interprofessional setting. The two Adult Health BSN students administered blood products while the two Obstetrics BSN students administered medications to control the hemorrhage as ordered by the SRNA.

During the scenario, students' performance was evaluated using rubrics designed by the faculty. Rubrics addressed the student's ability to recognize a problem, perform skills efficiently and safely, and delegate/follow orders/directions appropriately. If performance was not satisfactory, students returned to complete the simulation after further remediation from faculty. Upon completion of each scenario, a debrief was conducted with BSN and SRNA faculty, and all participants were invited to complete a survey administered through Google Forms by scanning a QR code that was developed by the researcher. The survey consisted of 17 items rated on a 5-point Likert scale (1= strongly disagree to 5 = strongly agree). The survey assessed students' perceptions of realism, role identification, communication, collaboration, delegation, teamwork, confidence, and overall effectiveness of working as an interprofessional team. The survey was completed immediately after to capture their perceptions of the experience. Due to the anonymity and voluntary nature of the survey, no demographic or identifying information was collected. All data was collected electronically and stored securely in the Google Forms platform.

The collected data was sent to a statistician within the organization. Survey data on the Likert scale is on the ordinal level of measurement. Many statistics textbooks recommend the use of nonparametric tests with Likert scale data.[10] Additionally, the Shapiro-Wilk test was used in each testing situation to assess goodness-of-fit to normality, where a statistically significant result indicates a deviation from normality. A Wilcoxon signed-rank test was used to look at confidence before and after the simulations. In addition, 11 Mann-Whitney U tests were performed comparing SRNA and BSN students in areas such as teaching methods, strengths and weaknesses, realism, role identification, and collaboration. All statistical analyses were run using R Version 4.5.1. To account for multiple testing and the possibility of increasing Type I error, p-values were adjusted using the FDR (false discovery rate) method. A level of significance of $\alpha = 0.05$ was used.

2.2 Neonatal emergency simulation

The neonatal emergency simulated a neonate in distress due to maternal hemorrhage. The care team consisted of one SRNA enrolled in the Obstetric and Pediatric course and two BSN students enrolled in the Obstetrics course. The neonatal care was based on the Neonatal Resuscitation Program (NRP) 8th edition guidelines.[11] The SRNA led the neonatal code, performing intubation, formulating a treatment plan, and delegating tasks. The BSN students assisted in clinical decision-making and performed interventions such as placing monitors, administering medications, providing oxygen, assigning APGAR scores, and performing chest compressions.

Students were assigned randomly to their teams and were not informed of the specific simulation scenario prior to arrival. All participants had received classroom instruction on the relevant obstetric and neonatal content. Each simulation lasted 15-20 minutes. Each group transitioned to the alternate scenario to allow for exposure and participation in both scenarios. All necessary equipment, medications, and supplies were available to support each simulation.

3. Results

Survey results revealed that 82.1% of students strongly agreed that working in an interprofessional format made the simulation feel more realistic, and 81% strongly agreed that this format enabled them to identify roles and responsibilities in an obstetric and neonatal emergency. The interprofessional format allowed students to collaborate with other care team members to improve patient care (77.9% strongly agreed), practice effective communication with

other providers (82.6% strongly agreed), and exercise delegation to facilitate patient care (79% strongly agreed). Overall, the interprofessional simulations promoted teamwork(84.6% strongly agreed) and allowed students to feel more confident (74.9% strongly agreed).

A Wilcoxon signed-rank test was conducted to determine whether there was a change in students' confidence before and after participation in the neonatal code and obstetric emergency simulations. For the neonatal code simulation: V = 58.5 with an adjusted p-value of $p < .0001$. For the obstetric emergency simulation, V = 81.5 with an adjusted p-value of $p < .0001$. The results of these tests are visualized in Figures 1 and 2. There was a statistically significant difference between the students' pre-test and post-test scores, indicating that students were more confident to participate in a neonatal code and obstetric emergency after the simulation. The normality assumption was assessed for both paired-samples comparisons using the Shapiro-Wilk test (both $p < .0001$).

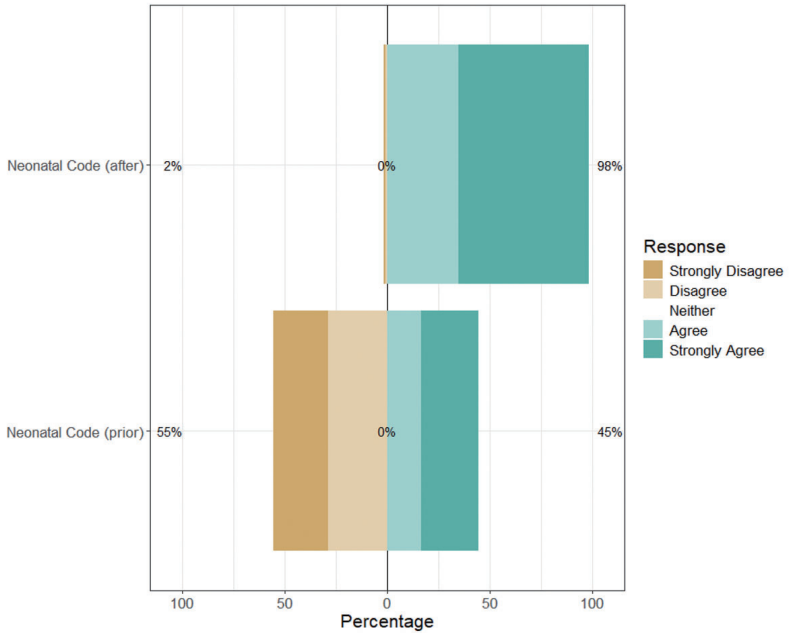

Figure 1. Neonatal code

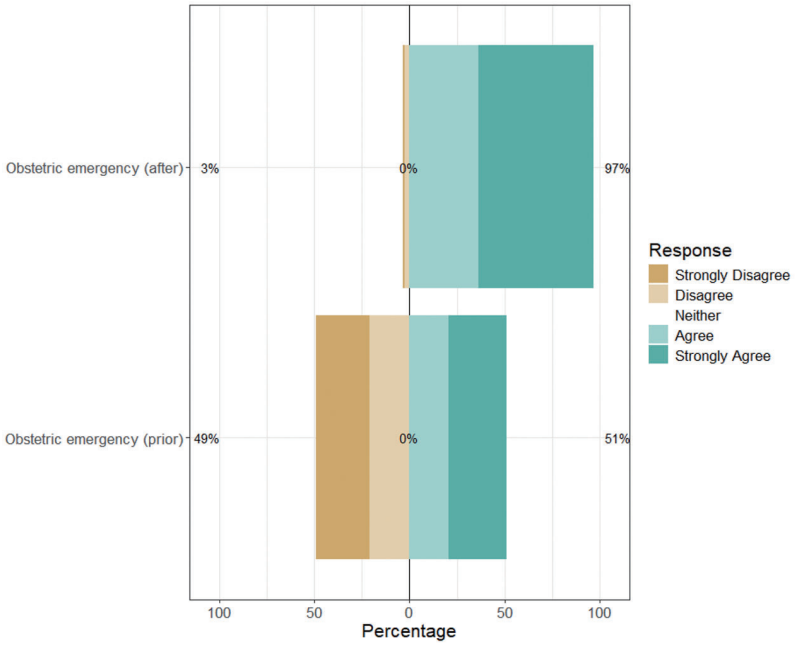

Figure 2. Obstetrical emergency

Eleven additional Mann-Whitney U-tests were completed comparing the BSN students to DNP Students in the following areas: Effective teaching methods, determination of strengths and weaknesses, motivation to learn, feel more confident, provide realism, identify roles and responsibilities, collaborate with other team members, and delegate responsibilities. Shapiro-Wilk tests showed all 11 items were significantly non-normal (all $p < .0001$). No statistically significant differences were found between the BSN and SRNA students when examining simulation as an effective teaching methods ($p = .1148$), a tool to determinate strengths and weaknesses ($p = .3410$)), feelings of increased confidence ($p = .1010$), collaborating with team members ($p = .1076$), and delegating of responsibilities ($p = .2456$).

Statistically significant differences were found between the BSN and SRNA students in the following areas: simulation was motivating/helpful for learning ($p = .0086$), simulation felt realistic ($p = .0086$), simulation aided in identifying roles and responsibilities ($p = .0086$), simulation aided in promoting teamwork ($p = .0146$), and practicing effective communication ($p = .0086$). For each of these items, the BSN students were more likely to strongly agree compared to the SRNA, although both groups were generally positive. These results are demonstrated in Figure 3.

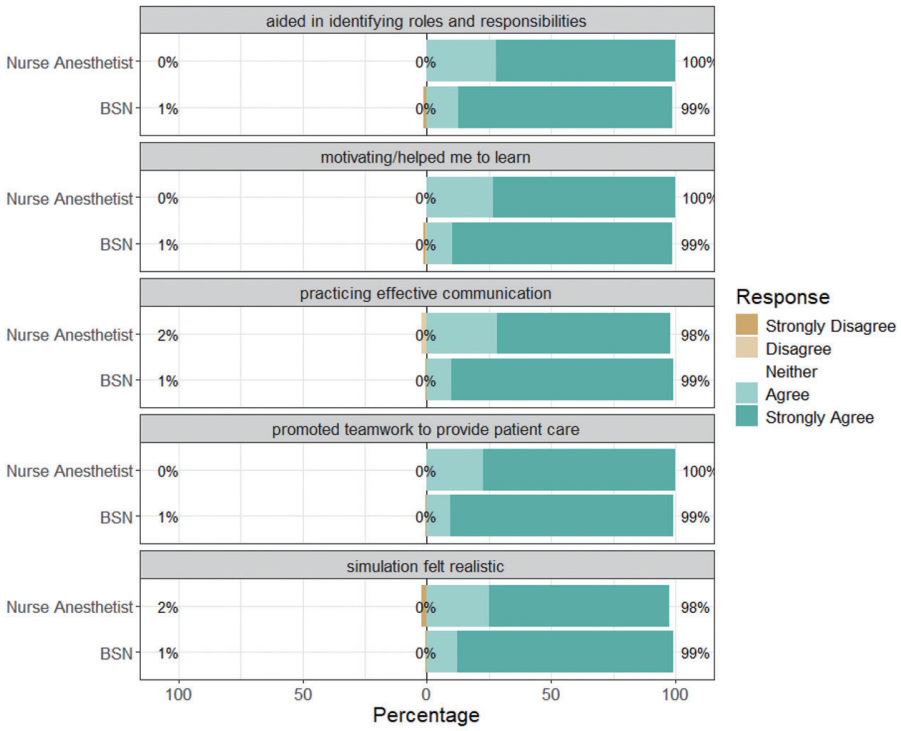

Figure 3. Areas of statistical significance: Comparison of BSN and SRNA students

Students were asked to respond yes or no to the question, "Would you like to do more interprofessional simulations?" To analyze the differences between BSN and SRNA groups a Chi-Square test was run: $\chi^2 = 3.6148$, df = 1, adjusted p-value = .1002, indicating no significant group differences. However, the vast majority in both groups said "yes" (99.4%), indicating support for the simulation regardless of program.

4. Discussion

Simulation has been shown to be an effective tool to enhance learning and improve critical thinking skills through clinical application and hands-on experiences, especially for rare, crisis events in practice.[12] Integrating a high-fidelity simulation increases realism without jeopardizing patient safety. Simulation provides consistency in learning environments, ensuring continuity in student clinical experiences and evaluation. This was supported in this project as 82.1% of students strongly agreed that the interprofessional format made the simulation appear more realistic.

The purpose of this study was to explore the impact of utilizing an interprofessional format for graduate and undergraduate simulation, focusing on realism, identification of roles, collaboration, communication, delegation, teamwork, and confidence. Survey responses indicated that not only does the interprofessional format improve the overall realism of the simulation, but frequent interprofessional simulations can

allow students to learn roles, responsibilities, practice teamwork, and improve communication skills in SRNA and BSN students. Additionally, both the SRNAs and BSN students were more confident regarding their ability to participate in a neonatal code and obstetric emergency following the simulation.

This study's findings support the implementation of interprofessional simulation in curriculum development to promote communication, delegation, teamwork, role identification, and confidence. Interprofessional simulation enables students to visualize other providers and the role they play in providing care for the simulated patient. No statistical differences were found between the BSN and SNRA students when examining simulation as an effective teaching method, feelings of confidence, identifying roles and responsibilities, collaborating with other team members, and delegating responsibilities. This implies that both the SRNAs and BSNs felt similar regarding the experiences the simulation provided in these areas.

Statistical differences were found between the SRNAs and BSN students in areas of simulation that evaluated motivation of learning, realism, encouraging communication practice, aiding in identifying roles and responsibilities, and promoting teamwork. However, the BSN students were more likely to strongly agree than the SRNA students. This may be due to the BSN students having less work experience than the SRNA students, who have practiced for at least a year as registered nurses. The BSN students have had little to no opportunities for participation in teamwork, communication, and collaboration as registered nurses. In addition, the SRNA students had several months (4-20) of intraoperative clinical rotations prior to this simulation experience, engaging with various healthcare professionals to coordinate patient care.

As each provider contributes to the care performed by the team, the responsibilities of each caregiver are highlighted, allowing BSN and DNP students to practice effective communication strategies, delegation, and teamwork in a crisis scenario. The interprofessional format of this study provided a safe space for students to explore delegation and role development without time constraints that could result in patient injury. Results from this project support the use of simulation as a method for promoting realism, identifying roles and responsibilities, promoting teamwork, and practicing effective communication in both BSN and SRNA student populations.

An important component of simulation is the debriefing period. This period encourages open communication and allows students to determine personal strengths and areas of improvement. Such discussions allow students to learn from their mistakes, ask questions, and recount the events in a non-threatening environment. Faculty feedback helps further define roles and provides suggestions for improved collaborative practice during similar situations. The more frequently interprofessional simulations are practiced and debriefed, the less likely care will be delayed when an emergency is encountered in clinical or practice settings.

4.1 Future implications

Despite the clear benefits to student learning and potentially improved patient outcomes, simulation is underutilized. Interprofessional simulation, in particular, is underutilized in rural nurse anesthesia programs due to high costs and limited resources.[13] The incorporation of integrated simulation experiences into a nursing program's curriculum requires funding for high-fidelity mannequins, facilities capable of recreating practice environments, and simulation-focused faculty dedicated to developing student experiences beyond clinical rotations. Nursing curricula should be focused on the expansion of experiential learning opportunities through the attainment of grants and partnerships. With the addition of simulation-focused faculty, programs should seek to improve student learning experiences through an enhanced simulation curriculum. Interprofessional simulation is one approach to enhancing integrated experiences, employing both graduate and undergraduate nursing students.

Further research should continue to explore the role of interprofessional simulation in other areas such as intensive care units, operating rooms, and post-anesthesia care units. Consideration of the role of interprofessional simulation across other disciplines, such as physical therapy, occupational therapy, respiratory therapy, and speech pathology, should be explored.

4.2 Limitations

Limitations to this study included a small SRNA sample size and the lack of pre-simulation data. A more descriptive Likert scale would have allowed for more accurate data. Potential barriers to student learning could include anxiety around not knowing the scenario of the simulation beforehand and the feeling of being judged by the other students in the group. Future research may include the integration of pre- and post-tests, as well as the incorporation of other interprofessional disciplines, a larger sample size, a more valid and reliable evaluation tool, and an organized, potentially rubric-based post-simulation debriefing.

Although limitations and barriers were identified, the study successfully explored the efficacy of interprofessional simulation. Students perceived that interprofessional simulation increased personal confidence and improved the reality of the scenario. Students indicated that the collaborative format

was effective in role and communicative skill development, desiring to participate in more interprofessional simulations. Due to the positive impact demonstrated in this study, the program has implemented additional high-stakes scenarios utilizing the interprofessional format to further improve simulated learning experiences.

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AUTHORS CONTRIBUTIONS
Tiffany Eye, DNP, MA-B, CRNA and Amy Cook, DNP, CRNA contributed equally to the conception and design of the study, data collection, and the drafting and editing of the manuscript. Drs. Eye and Cook served as lead faculty overseeing all phases of the project. Erica Brown, DNP and Jennifer Rogers, DNP, FNP-BC supported study design focusing on BSN content, and contributed to data collection and manuscript drafting and editing. Prof. Chris Mecklin provided statistical analysis, including statistical figures and manuscript preparation. All authors reviewed and approved the final manuscript.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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No additional data are available.

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