Spring 2018

Measuring Nursing Students' Perceptions of Teamwork in a Multiple Patient Simulation

Christine Seaton, DNP, MSN
George Washington University

Measuring Nursing Students' Perceptions of Teamwork in a Multiple Patient Simulation

Presented to the Faculty of the School of Nursing

The George Washington University

In partial fulfillment of the

requirements for the degree of

Doctor of Nursing Practice

Christine Seaton, MSN

DNP Project Team

Karen Wyche, PhD

Patricia Davis, DNP

Date of Degree: Spring 2018

Abstract

Background: Simulation based education offers safe, reflective learning opportunities. However, data had not been obtained of nursing students' perceptions of teamwork performed during Virtual Hospital (VH), a multiple patient simulation.

Objectives: This evaluation gap was addressed using the Agency for Healthcare Research and Quality's (AHRQ) TeamSTEPPS® Teamwork Perceptions Questionnaire (T-TPQ). The validated survey measures self-reported perceptions of teamwork in communication, mutual support, and situational awareness on a Likert scale from 1 to 5 (AHRQ, 2014).

Methods: A pre-and post, one group design was used to measure perceptions of teamwork. Twenty participants were recruited from students, enrolled in a second-degree undergraduate nursing program, scheduled to complete VH in ten predetermined clinical teams. Participants, dispersed among six of the teams, used the T-TPQ to rate perceptions of their teamwork before and after VH. Aggregated pre- and post-VH T-TPQ responses were compared for differences in total and subscale scores. These results were compared to faculty assessments of team communication using the traditional VH evaluation tool.

Results: Nonparametric analysis indicated significant differences between pre- and post-VH T-TPQ total scores ($p = 0.031$), between pre- and post-VH communication subscale scores ($p = 0.034$), but no difference between scores for pre- and post-VH mutual support or situational awareness subscales ($p = 0.059$). Faculty evaluations reported three of six teams met communication expectations.

Conclusions: Overall, students perceived VH as an opportunity to practice and assess teamwork, and particularly communication, with a validated, self-report questionnaire (T-TPQ). These findings reinforced its integration in the learning environment.

Background

The Institute of Medicine's (IOM) landmark report, *To Err is Human*, informed the nation of the need for safety reform in healthcare (Kohn, Corrigan, & Donaldson, 2000). Later recommendations by the IOM for interprofessional and healthcare teamwork education were part of a unified strategy of quality and safety improvements (Greiner & Knebel, 2003, Van Geest & Cummins, 2003). While advances in healthcare team training in medical and nursing curricula have been made, concerns persist over suboptimal care and serious adverse events related to poor teamwork (Baker, Day, & Salas, 2006; Hobgood et al., 2010; McGaghie, Issenberg, Petrusa, & Scalese, 2010; Rahn, 2016; Reime, et al., 2016). Rahn (2016) posited that inadequate teamwork originated from healthcare providers working in isolation, without acknowledgment of shared responsibility or accountability for critical incidents involving the team (p. 263).

Although nurses are integral members of healthcare teams, they are educated and evaluated primarily as individuals during their nursing programs (American Association of Colleges of Nursing, 2008; Pauly-O'Neill, Cooper, & Prion, 2016). The Quality and Safety Education in Nursing (QSEN) collaborative identified key attributes of competent teamwork as the ability to work with members within and outside of their professions, respecting the contributions of all team members when making decisions, and effective communication skills (Cronenwett et al., 2007; QSEN, 2014). Communication is vital to teamwork, key to effective leadership and delegation skills, and contributes to a shared understanding of team roles and objectives (Baker, et al., 2006). Additional elements of effective teamwork are mutual support and situational awareness (Baker, et al., 2006; Salas, Wilson, Burke, & Priest, 2005). Mutual support in a team is acknowledged as modified actions and task responsibility to meet shared goals through assistance and feedback about current performance to one or more team members

(Salas et al., 2005). Situation awareness has been defined as a continuous monitoring of the environment with assessment updates shared among team members (Hunt, Shilkofski, Stavroudis, & Nelson., 2007, p. 303). Baker et al. (2006) defined situation awareness as "the ability to develop common understandings of the team environment and apply appropriate task strategies in order to accurately monitor teammate performance" (p. 1581). Situational awareness on medical surgical units, for example, is critical to prompt recognition and response to patients' deteriorating conditions (Bright, Walker, & Bion, 2004).

Researchers have found that providing nursing students with real patient care experiences, defined as "authentic" clinical experiences, in order to develop and practice teamwork skills was challenging due to the limited availability of clinical sites, the need to maintain patient safety, and the unpredictability of the care environment (Jeffries, Clochesy, & Hovancsek, 2009; Pauly-O'Neill et al., 2016). Simulated clinical experiences offered an alternative learning environment in which nursing students safely applied teamwork skills (Cant & Cooper, 2009; Jeffries et al., 2009; Kalisch, Weaver, & Salas, 2009). Gaba (2004) defined simulation as a guided methodology of techniques that represented actual conditions and realistic environments for interactive learning. In addition to making provision for safe and deliberate practice, simulation-based education has been utilized to evaluate individual and team clinical judgment and skills (Cant & Cooper, 2009; Gaba, 2004; Hallin, Backstrom, Haggstrom, & Kristiansen, 2016; Jeffries, et al., 2009; Lewis, Strachan, & Smith, 2012; McGaghie et al., 2010; Motola et al., 2013).

Simulation-based education (SBE) has demonstrated effectiveness in achieving student satisfaction, reaching intended educational outcomes in healthcare education, and is endorsed by educators and healthcare organizations (Cant & Cooper, 2009; Cook et al., 2012; Jeffries, et al.,

2009; Kalisch et al., 2009; Motola et al., 2013). SBE, when compared to similar active learning methods or no intervention, was similar or superior in improving a learner's technical skills, knowledge, and perceived clinical confidence, as well as specific aspects of teamwork, including communication, mutual support, and situational awareness (Cant & Cooper, 2009; Cook et al., 2012; Hobgood, et al., 2010; McGaghie et al., 2010; Motola et al., 2013; Patterson et al., 2008).

Problem Statement

Effective teamwork is essential to the delivery of quality healthcare (Greiner & Knebel, 2003; Kohn et al., 2000). However, Pauly-O'Neill et al. (2016) found that nursing students spent less than 10 % of their time in clinical rotations practicing teamwork skills. Nursing students had even less clinical opportunities to perform teamwork in the simultaneous care of multiple patients or assess their teams' performance prior to transitioning to practice (McNelis, & Ironside, 2009; Ulrich et al., 2010). Consequently, current practices in undergraduate nursing education have provided inconsistent clinical experiences and robust supervision which have hindered development, demonstration, and assessment of teamwork skills. As a result, an imbalance between academic preparation and practice expectations was created (McNelis & Ironside, 2009; Ulrich et al., 2010). Research findings also substantiate nursing students' gap in teamwork skills with significant deficiencies in communication and situational awareness (Hart et al., 2014). Therefore, educators should assess learner perceptions of collective teamwork as part of the evaluation of student practice readiness. Furthermore, clinician perceptions of teamwork have been associated with quality healthcare outcomes (Manser, 2009).

The available literature on student perceptions has focused on an individual's general confidence to perform as a team member or team leader and the ability to prioritize (Josephsen, 2013). When SBE techniques are employed, evaluation has predominantly been through student

self-assessment of confidence or through faculty evaluation of critical thinking among team members (Hallin et al, 2016). As a result, a gap exists in the assessment of learners' perceptions of collective team performance in key criteria: communication, mutual support, and situational awareness. Additionally, there are deficits in opportunities to assess perceived team performance in the care of multiple patients. These lack of opportunities result in knowledge gaps that negatively affect nursing students' optimal transition to practice and the delivery of quality healthcare through effective nursing teamwork (Manser, 2009; Rahn, 2016; Van Bogaert et al., 2014).

Purpose

The purpose of this project was to address the assessment gap of student perceptions of collective team performance (communication, mutual support, situational awareness) in the care of multiple, simulated hospital patients. Nursing students' perceptions of collective team performance, identified as "teamwork" in future references, were obtained and measured using a modified version (see Appendix A) of the Agency for Healthcare Research and Quality's TeamSTEPPS Teamwork Perceptions Questionnaire (T-TPQ; AHRQ, 2014), before and after a clinical simulation experience that represented authentic team care of multiple hospital patients (Virtual Hospital). The resulting T-TPQ mean scores from Virtual Hospital (VH) performances were compared for differences between the pre-Virtual Hospital (pre-VH) and post-Virtual Hospital (post-VH) multiple patient simulation (MPS). Additionally, faculty evaluation scores of students' teamwork performance, measured using the usual Virtual Hospital On Campus Clinical Report (OCCR) Form (see Appendix B), were examined to assess teamwork communication in comparison to student reported post-VH T-TPQ scores.

Aims

The Doctor of Nursing Practice (DNP) project aims were to:

1. Measure nursing students' perceived teamwork on communication, mutual support, and situational awareness before participation in Virtual Hospital.
2. Measure nursing students' perceived teamwork on communication, mutual support, and situational awareness after participation in Virtual Hospital.
3. Compare differences in nursing students' perceived teamwork on communication, mutual support, and situational awareness before and after participation in Virtual Hospital.
4. Compare differences in nursing students' perceptions of team communication with faculty evaluation of students' team communication.

Research Questions

Four research questions guided this project of measuring and comparing student perspectives of teamwork as measured by the T-TPQ before and after participation in SBE.

1. What are nursing students' perceptions of their teamwork, as measured by T-TPQ, in the simultaneous care of multiple patients prior to participation in Virtual Hospital?
2. What are nursing students' perceptions of their teamwork, as measured by T-TPQ, in the simultaneous care of multiple patients after participation in Virtual Hospital?
3. Is there a pre-post difference in nursing students' perceptions of teamwork, as measured by T-TPQ, in the simultaneous care of multiple patients following participation in Virtual Hospital?
4. Is there a difference in faculty assessment of nursing students' team communication and student perceptions of team communication after participation in Virtual Hospital?

Significance

Gaps in teamwork assessment and performance must remain a concern for educators as they prepare the future nursing workforce. Based on the study results of nursing student satisfaction in current literature, nursing students seem satisfied with SBE. However, student and faculty evaluation of SBE teamwork have been slow to develop (Cant & Cooper, 2009; Jeffries, et al., 2009; Ironside, Jeffries, & Martin, 2009; Kalisch et al., 2009). This DNP project provided specific, validated measurements and comparisons of nursing student perceptions of communication, mutual support, and situational awareness in response to a homogenous SBE experience focused on nursing student teams autonomously caring for multiple hospital patients. In addition, the project provided opportunities to compare student perceptions of team communication with faculty assessment of team communication. The simulation laboratory was ideally suited to facilitate consistent clinical experiences of caring for multiple patients and evaluation of nursing teamwork. The uniformity of the simulated clinical activity aided in quantitative assessment of learners' perceptions of teamwork without the confounding effects of diverse clinical environments.

This DNP project extended the evidence on nursing student teamwork in three distinct ways:

- AHRQ's T-TPQ (2014) was used to measure specific teamwork skills, including communication, situation awareness, and mutual support. Use of the T-TPQ enabled a valid, quantitative analysis of these teamwork skills.
- The project measured student perception of teamwork associated with a multiple patient simulation (MPS) designed to represent authentic nursing practice hospital environments (Kovner, Brewer, Fatehi, & Katigbak, 2014). This design differed

from a majority of SBE studies focused on singular hospital patient care provided by nursing students (Ironside, et al., 2009), or multiple patient care performed in prehospital disaster settings (Cant & Cooper, 2009).

- The project measured student perception of teamwork associated with a SBE that occurred over a half day, which was a closer representation of an authentic clinical experience (Ayers et al., 2015). The design differed from many SBE studies of teamwork with limited simulation experiences of 30 minutes or less. Virtual Hospital's extended scenario timeframe provided a greater number of opportunities for faculty and students to assess teamwork in complex, autonomous clinical practice.
- The project compared student perceptions of teamwork communication to faculty assessment of team communication.

This approach reflected recommendations made by Harris, Eccles, and Shatzer (2017) who argued that deliberate team practice should include "prolonged engagement in increasingly difficult…. activities" based upon evidence from "clear…. quantifiable measures of performance" (p. 212). It was anticipated that measurement of SBE nursing teamwork enhanced a better understanding of students' perceptions of teamwork in the simultaneous care of multiple hospital patients.

Literature Review

A review of the literature addressing nursing students and teamwork performance in patient simulation was undertaken. PubMed, Academic Search Complete, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and Education Resources Information Center (ERIC) served as bibliographic databases for the review. A combination of search terms included

team, patient care team, simulation, patient simulation, nursing education, hospital, multiple patients, and multiple scenario. English language and human subject filters were applied to the searches. No date restriction was imposed.

The PubMed search resulted in 251 titles and the CINAHL, ERIC, and Academic Search Complete search resulted in 57 titles. Reference lists from articles pertaining to nursing students or multiple patient scenario designs were examined and contributed another seven titles. A total of 315 titles were obtained from the literature search. Two duplicates were excluded, as were papers that did not include nursing students or a multiple patient scenario design. Titles of computer-based and virtual simulation scenarios were excluded as well as titles of prehospital or disaster simulation scenarios, which differ considerably by setting and methodology from the proposed research. After these exclusions, 17 titles remained relevant to the topic of this project.

The 17 retained titles addressed four key topics: placement of simulation activity within the nursing program, the design of the simulation, the methods of evaluation, and the outcomes achieved. The placement of the simulation activity varied considerably from study to study. In one case, students at a mix of program levels participated in the activity (Leonard, Shuhalbar, & Chen, 2010). In another example, the simulation was only made available to senior nursing students (Kaplan & Ura, 2010; Liaw et al., 2014).

The retained studies reported various design characteristics of the simulation activities:

- Setting contexts in adult and pediatric populations (Davies et al., 2012; Gamble, 2017)
- Teams composed of interprofessional healthcare students (Joyal, Katz, Harder, & Dean, 2015; Ker, Mole, & Bradley, 2003) or solely intraprofessional (nursing) students (Mole & McLafferty, 2004)

- Scenario duration ranging from 30 minutes (Ironside et al., 2009) to hours (Pearson & McLafferty, 2011) to 4 days (Ayers et al, 2015)
- Simulated patient health status depicted in the scenario: stable (McGrath, Lyng, Hourican, 2012) to changing health conditions (Franklin, Sideras, Gubrud-Howe, & Lee, 2014)
- Simulated patient realism facilitated by trained actors (Nikendei et al., 2016), computerized manikins (Bishop & Stewart, 2014; Frontiero & Glynn, 2012), or a mixture of actors and computerized manikins (McGrath et al., 2012).

By design, Virtual Hospital is a requirement of the usual clinical education in the student's final semester of the accelerated Bachelor of Science Nursing (ABSN) program and reflects the extant literature in its potential effect upon learners and their clinical growth (Barkimer, 2016). For example, Horsley, Bensfield, Sojka & Schmitt (2014) posited that realistic, clinical simulations that progress in complexity (Liaw et al., 2014; Franklin et al., 2014) are well suited for students further along in their education to foster development of communication, care management, and leadership abilities. Bradbury-Jones, Sambrook, and Irvine (2007) reported that teamwork and continuity of the clinical experience fostered nursing student empowerment and learning engagement. Similar findings in simulated clinical settings using scenarios of longer duration have enhanced nursing students' knowledge, impressions of realism, and their heightened sense of professional responsibility with autonomous and self-directed learning experiences (Ayers et al., 2015, Cook et al., 2012, Davies, Nathan, & Clarke, 2012; Joyal et al., 2015; Ker et al., 2003).

Qualitative approaches were used in several studies that explored student responses to SBE teamwork (Ayers, et al., 2015; Nowell, 2016). For example, Ayers et al. (2015) identified

themes of "true to life" and "not ready for prime time" that emphasized a student knowledge-practice gap (p. 21). Nowell (2016) elaborated on student expressions of apprehension prior to SBE and confidence in collaboration after the SBE (p.55). Chieh-wen, Yi-fang, and Ming-chia (2010) contended that team support was perceived as a valuable element and leads to desired team performance. Learner evaluation beyond student self-assessment of preparedness and confidence (Kaplan & Ura, 2010) included quantitative expert rater assessments of teamwork performance (Ironside et al., 2009). Very few of the retained studies addressed perceptions of team care of multiple, simulated patients or specific teamwork skills which would inform educators and researchers of pertinent elements to incorporate into effective SBE design and debriefing (Blodgett et al., 2016; Cant & Cooper, 2009; Horsley et al., 2014).

Autonomous performance was considered another significant area within SBE and teamwork, especially when coupled with simultaneous, multiple patient care. Limited qualitative findings in the literature have indicated that team based, multiple-patient hospital ward SBE promotes the development of team skills in communication, situation monitoring, role comprehension, team support, and perceptions of shared goals (Joyal et al., 2015, Pearson & McLafferty, 2011). However, the lack of quantitative data regarding nursing student perceptions of teamwork skills in the literature illuminated the need for further study using a validated instrument designed to capture quantitative information on communication, mutual support, and situational awareness.

Theoretical Framework

The integration of clinical practice and various educational methods, including learner centered SBE, has developed through theoretical influence upon research and nursing curriculum design (Aliakbari, Parvin, Heidari, & Haghani, 2015). This DNP project coupled an interpretivist

perspective with social constructivist theory as a framework to understand the nursing students' perceptions of teamwork during a simulated clinical experience. Learning has occurred, from the interpretivist perspective, as a result of a learner's perception of and interaction within a realistic simulated scenario (Nestel & Bearman, 2015). Social constructivist theory adheres to an interpretivist view of learning. In 2013, Schreiber and Valle described social constructivism as a form of constructivist theory in which an individual assembles knowledge from individual experiences and social interactions over the course of their lifespan. Vygotsky's social constructivist theory (in Powell & Kalina, 2009) is used in education to explain the benefit of group interactions to learning, including group simulation activity, with faculty facilitating rather than directing learning (p. 247). Social constructivist theory supports the DNP project's premise that SBE experiences influence perceptions of teamwork as the participants interpret and build greater understanding and awareness of team performance through interaction in clinical experiences.

Progressive simulation experiences provide opportunities to construct new meanings when synthesized with previous learning (Hansen & Bratt, 2017; Peters, 2000). Consequently, the VH design and assessment of learner perception were essential to facilitate and understand student learning. The SBE experience utilized in this DNP project, Virtual Hospital (VH), was situated in the final semester of an undergraduate ABSN nursing program. It was preceded by coursework and clinical experiences which provided introductory teamwork information and practice experiences. VH involved a novel clinical experience of providing autonomous team care for multiple hospital patients. This opportunity was considered vital for learners to broaden collaborative experiences, explore individual scope of practice abilities, and assess teamwork performance through reflective discussions.

As explained by Cobern (1993), social constructivist theory implies that educators must be able to understand and acknowledge, through discourse and investigation, the student's interpretive learning process (p. 109). Discourse in VH has been fostered by reflective conversations known as guided debriefings held after each session (Ironside et al., 2009). Further investigation of learners' perceptions of teamwork was accomplished by examining pre-VH and post-VH responses to the T-TPQ (AHRQ, 2014).

Identifying and Defining Variables

A modified version of the T-TPQ (AHRQ, 2014) served as the instrument to measure perceived teamwork performance, a dependent variable of the project. Learner response scores for communication, mutual support, and situation awareness were obtained immediately before and immediately after the VH multiple patient simulation (MPS) session, the independent variable of the project. The project's variable descriptions and definitions are provided in Table 1 (see Appendix C). Participant age, prior military service, ethnicity and gender were demographic variables identified at the onset of analysis (see Appendix D). These variables were considered relevant to teamwork performance and possible confounding interpretation of learner perceptions. In a social constructivist paradigm, the rationale for demographic variable identification is that a learner's ability to construct new knowledge from one's experiences increases as the leaner ages and encounters new experiences, or increases though robust teamwork training, a predominant practice in the Unites States Armed Forces (Baker et al. 2006, p. 1585). Ethnicity and gender were not reported in the reviewed literature and were recorded to assess relevance to teamwork in SBE.

The VH On Campus Clinical Report Form (OCCR), a second dependent variable of the project, measured faculty evaluation of student team communication on seven different criteria.

The evaluation used a three-point scale (0= unsatisfactory, 1= needs improvement, 2= meets expectations). Faculty scores rating the students' team communication were obtained during the team VH session as part of the usual evaluation practice.

Methods

Methods Overview

A one group, pre-and post, pilot study design was used to measure perceptions of teamwork. Students from an undergraduate, second degree nursing cohort were invited to respond to a short survey about their perceptions of teamwork before and after participation in Virtual Hospital (VH), a multiple patient simulation (MPS) experience.

Research Design

The DNP project used a prospective, quasi-experimental design without a control group. The prospective design permitted the project to be completed during the allotted time frame. The quasi-experimental design accommodated a clinical policy of predetermined student teams, as well as the researcher's lack of blinding to student teams, team members, and faculty evaluations of team members during VH sessions. The single group of consented students were enrolled in the accelerated Bachelor of Science Nursing (ABSN) course that required all nursing students complete a VH session. The one group, pre and post design permitted use of the TeamSTEPPS® Teamwork Perceptions Questionnaire (AHRQ, 2014) to describe the same outcome measure: learner perception of teamwork. The null hypothesis was that there would be no difference in mean pre-VH and post-VH T-TPQ scores.

Study Population/Sample:

Male and female nursing students in the last semester of their ABSN program in the George Washington University (GWU) School of Nursing (SON) comprised the eligible

population (*N*=83). All the students in the cohort had pursued previous undergraduate course work and received instruction about best practices in teamwork within the GWU SON prerequisite course entitled "Patient Safety and Quality".

Setting

The GWU SON Simulation Learning and Innovation Center (SLIC) on the Virginia Science and Technology campus was the setting for the VH simulation activities. There were two private rooms and eight semi-private areas within the space that replicated an actual hospital unit. Video equipment, microphones, and room speakers enabled faculty to see and hear student interactions with each other and the simulated patients. The nursing students were familiar with the lab, manikins, and other equipment, most of which were used throughout all semesters of the cohort's program. Teams of eight to eleven nursing students cared for six to seven simulated hospital patients (manikins and trained actor) during VH.

Sample Size

Hertzog (2008) recommended clinical importance be taken into consideration when determining effect size and statistical power, as well as having a sample size of at least 20 for pilot studies attempting to "demonstrate intervention efficacy in a single group" or to "specify meaningful group differences" (p. 190). The entire cohort of 83 students was approached to maximize the possibility of a 20% response rate recommended for a pilot study. If normality assumptions were not met for the T-TPQ data, a non-parametric Wilcoxon Signed Ranks test was planned to test the null hypothesis that no difference existed between mean pre- and post-test scores (M. Dowling, personal communication, March 27, 2017). The resulting number (n) of participants (n=20) met the 20% response rate, however, aggregated T-TPQ subscale and

composite data (see Appendix E) was obtained from participants dispersed among six different teams (n=6).

Inclusion and Exclusion Criteria

All students who were in their last semester of the GWU SON ABSN degree program, enrolled in course NURS 4120 by the start of the project, and who voluntarily agreed to participate were eligible for the study (see Appendix F). The enrolled students met inclusion criteria of speaking, reading, and writing in English. The excluded were students not enrolled in NURS 4120 and were students not in their last semester of the GWU SON ABSN degree program.

Recruitment of Study Participants

It was expected that it would take one month to recruit participants into the project as many of the students were on campus less often during the semester prior to the project's start (see Appendix G). Recruitment was accomplished one month prior to the project's start through the placement of on campus flyers (see Appendix H) and notices sent to student email addresses (see Appendix I). Flyers were placed by the elevators, outside the SLIC, and in a campus student lounge one month before the start of the project.

At the start of the semester, a classroom announcement was made during the NURS 4120 course, by a faculty member not associated with the study. The project's informed consent (see Appendix F) was made available for review during and after the announcement. The announcement explained the project, the availability of the consent form, and provided details for further information to every eligible student. Students interested in participating were instructed to return the signed consent form to a secure location on the GWU SON campus. The informed consent described the purpose of the project, the survey used, the delivery method of

the questionnaire, the collection of minimal demographic information (age, gender, military service, ethnicity) with the VH survey, and assurance of privacy with personal information and survey response. The participants were informed of potential risks, including potential loss of confidentiality due to loss of cybersecurity protection. The subjects were informed that participation was without monetary benefit. Finally, it was explained to students that declining to participate in the study or not participating after assenting did not affect clinical placement or course grading.

Intervention

Every student enrolled in the project participated in VH, a simulation clinical session completed by all students in multiple cohorts of the ABSN program as part of the usual NURS 4120 course requirements since 2010. The VH activity represented three hours of a clinical shift in a simulated hospital setting that included a nurse's break room, two private patient rooms, and a large semi-private ward area. Supply cabinets and carts, medication bins, and a phone system were present in the setting. Only one team of 8 to 11 nursing students participated in a VH session at a time. The session was completed during a single, half-day visit to the Simulation Learning and Innovation Center. It took approximately three weeks for eight teams to complete the VH clinical sessions. Students who consented to the study could have been in any of these eight teams.

All the SBE scenarios were previously developed using the SON program's approved simulation templates. The VH scenarios included two post-operative patients (exploratory abdominal surgery, mastectomy) and four patients with common medical diagnoses that represented an authentic clinical environment. Two patients had respiratory diagnoses: chronic obstructive pulmonary disease and pneumonia. The other two scenarios had patients with

neurological concerns of altered mental status. Multiple manikin modalities, from static to computerized, were used to represent five of the patients. The role of the sixth patient was played by a trained actor. Use of a trained actor and a variety of manikin modalities are effective in achieving SBE outcomes (Ayers et al, 2015; Joyal, et al, 2015; Liaw et al, 2014).

Nursing faculty and the trained actor, who have received instruction in SBE, directed the simulation activity and guided the debriefing session after the activity. Training in SBE, conducted by certified healthcare simulation educators employed by the SON, was accomplished using an established curriculum of classroom instruction in simulation methodology and debriefing techniques, as well as deliberate practice with rehearsing scripts and using audio visual equipment in trial simulations. Modeling of facilitation was provided for each faculty member to mitigate bias due to personal interpretation or unfamiliarity with VH.

Standardization of VH simulation was achieved in scenario development, student preparation, equipment use, and faculty facilitation. First, all patient scenarios were created to run the length of the simulated shift. The scenarios were delivered without alteration in patient status or any ordered therapy from the scripted course. A ten-minute introduction to the simulation space and equipment, called a pre-briefing, was scripted for consistent delivery to all teams by the simulation operations technician. The equipment did not change from one team activity to another within the cohort. Nursing faculty facilitated two patient scenarios at a time for each team activity and did not spontaneously switch patient scenarios they facilitated over the course of the three-week period to support consistent scenario progression. Each simulation activity started with the nursing students receiving a handoff report on all patients. The report was recorded to ensure reliability of the information given to each team. The team had 45 minutes to determine individual assignments and review patient charts. Care of the patients

ensued over two hours and thirty-minutes followed by a group debriefing session about one hour in length.

Instrument and Measurement

Different tools were used to collect data in this study. The DNP project used the T-TPQ survey that was formatted for online access. The T-TPQ was made available to only project participants through the Internet site Survey Monkey®. The participant signed into the survey using a randomly chosen, unique study identifier and completed demographic questions about age, gender, ethnicity, and military experience before answering the T-TPQ (AHRQ, 2014) questions. The T-TPQ, a validated instrument for measuring perceptions of teamwork performance, was used to survey the nursing student teams before and after participation in VH. The American Institutes for Research created the T-TPQ and provided it for public use through AHRQ (2014). In this project, the T-TPQ wording was minimally adapted by replacing the word "staff" with "student nurses" (see Appendix A). A paper and pencil tool, the Virtual Hospital OCCR Form (see Appendix B) was used to collect faculty scores of students' team communication. An electronic spreadsheet tool was used as a data collection worksheet with sections to record aggregate team T-TPQ subscale and total scores as well as faculty ratings of team communication (see Appendix E).

In its original version, the T-TPQ consists of thirty-five items divided equally into five subscales: team function, leadership, situation monitoring, communication, and mutual support (AHRQ, 2014). There are seven questions measuring each of the subscale constructs. Using the original 35 question version, authors have reported construct validity of Cronbach's alpha 0.978, a Comparative fit index (CFI) of 0.947, and a root mean square error of approximation of 0.057 (Keebler et al., 2014). Keebler et al. (2014) employed the T-TPQ in a large study involving 1700

healthcare professionals and posited that the T-TPQ was valid and very reliable for use in healthcare settings to measure five essential teamwork dimensions: communication, leadership, mutual support, situation monitoring, and team structure.

According to the American Institutes for Research (2010), the T-TPQ can be customized in subscale administration and retain reliability and construct validity (p.9). For example, each subscale can be administered in isolation from the other scales (p.9). For the DNP project, 21 items within the subscales for communication, situation monitoring, and mutual support were administered. Each question was scored from 1 to 5 on a Likert scale: 1 ("strongly disagree"), 2 (disagree"), 3 ("neutral"), 4 ("agree"), and 5 ("strongly agree") (see Appendix D). The total score for each of the individual subscales ranges from 21 to 105. Higher cumulative scores and higher mean scores for aggregated data are indicative of better perceived team performance in each case. The possible sums for the individual subscales range from 5 to 35 as displayed in a sample data collection sheet (Appendix E). It was estimated that a student would be able to complete the 21-item survey in less than ten minutes.

Data Collection Procedures

Demographic data was collected using an online survey format prior to the VH session and after consent was obtained (Appendix A). The online survey was available only when the VH simulation operations technician was present on site to provide the pre-and post-intervention survey links and mobile devices to participants. A unique survey identifier was selected by each subject that enabled matching participant pre-and post-intervention responses in Survey Monkey. The students were familiar with the Learning and Innovation Center mobile devices and the Survey Monkey site, both of which had been used throughout the nursing program. The online survey design accommodated three "pages" with one page devoted to each subscale. This format

aided with scrolling on mobile devices and helped to prevent "survey fatigue" that could have led to dropout (Survey Monkey, 2017). To promote complete survey responses, the online format required answering a question before moving to the next question. Several weeks before the start of the study, the online survey design, data entry, and data download processes were created and tested prior to administration. The students completed the post intervention survey prior to the standard SBE debriefing segment, routine for students in VH, to minimize bias. Data was downloaded by the researcher from Survey Monkey to a spreadsheet. Faculty evaluation data was obtained from the VH OCCR. The faculty data and the Survey Monkey data were entered and stored in SPSS 24 software. All entries were double checked by the researcher for mistyped or missing information. Spreadsheet and SPSS 24 data analysis results were stored on the researcher's laptop and an external hard drive in a locked office.

Data Analysis Plan

Aggregated pre-and post-Virtual Hospital respondent scores were appraised regarding perceived team performance, ranked in three operational categories (subscales) and as a composite. Data analysis with descriptive statistics were based on recorded differences between pre and posttest team scores. Faculty assessment of student communication scores were also aggregated by nursing student teams and examined for correlations.

Ethical Considerations

Ethical considerations involved protecting the rights of human subjects (nursing students) and ensuring that they were kept free from potential harm. The nursing researcher was compliant with required Collaborative Institutional Training Initiative (CITI) certification to understand the ethical issues and current guidelines for conducting human subject research. (CITI, 2017). Consequently, nursing students voluntarily consented to enroll in the study once Internal Review

Board (IRB) approval was obtained. IRB approval was granted from the George Washington (GW) IRB. Upon IRB approval, recruitment was initiated. When students responded to the recruitment invitations, the consent form was available for student review, and an information session was offered to answer questions prior to student assent or opting out of the study. The written informed consent described the purpose of the project, the survey to be used, the delivery method of the questionnaire, the tool to collect minimal demographic information (age, gender, military service), and assurance of privacy with personal information and survey response. A copy of the signed consent form was provided to the student.

Risks and benefits of the research project were described in the written consent form and explained to participants. The potential risks associated with participation in this project were like those ordinarily encountered in daily life or during the performance of routine questionnaires about thoughts and beliefs. Privacy risks of research data stored on the internet site Survey Monkey compromised by a cybersecurity breach did not occur nor did protection of unique survey identifiers connected to responses in the secured data collection phase and storage lapse. Another measure to protect the research data and provide IP address security for the participant included the use of a Secure Socket Layer (SSL) encryption feature available from Survey Monkey (Survey Monkey, 2017). The confidential project data was password protected on the Internet and on the external hard drive during the entire collection period of four weeks. Signed copies of the project's written informed consent form and data collection tools have been and will continue to be kept securely stored in a locked office for a minimum of three years.

Results

There were 21 student volunteers, with one participant not attempting the pre-VH or post-VH survey and 20 participants (N=20) who completed the pre-VH and post-VH T-TPQ. Sample

characteristics (see Table 2. Appendix J) revealed most participants were females (90%), between the ages of eighteen and twenty-eight years of age (60%), did not have military experience (95%), and described their ethnicity as White (85%). Participant characteristics of gender and age were reflective of the ABSN cohort from which they came. The percentage of male participants (10%) was close to the percentage of male students in the ABSN cohort (13%) as was the age range for participants (60% <29 years of age) when compared to the ABSN cohort (67% <30 years of age). However, the ABSN cohort had a higher proportion of military veterans (18%) than the sample (5%) and was ethnically twice as diverse (34%) as the sample (15%).

Perceptions of teamwork

To answer the research questions one through three, results of pre-VH and post-VH T-TPQ composite and subscale mean scores from 20 students dispersed among six teams were aggregated (see Table 3, Appendix K). Normality assumptions were not met for the data (see Table 3, Figures 1 and 2, Appendix K). A non-parametric analysis was performed using exact figures (see Table 4, Appendix L). The Wilcoxon Signed-Ranks test results (see Table 5, Appendix L) indicated statistical significance ($p < 0.05$) between pre-VH composite T-TPQ scores and post-VH composite T-TPQ scores ($p=0.031$). Statistical significance was noted between pre-VH Communication Subscale (CS) T-TPQ scores and post-VH CS T-TPQ scores ($p=0.034$). No differences were noted between pre-VH Situational Awareness Subscale (SAS) T-TPQ and post-VH SAS T-TPQ scores ($p=0.059$) nor between pre-VH Mutual Support Subscale (MSS) T-TPQ and post-VH MSS T-TPQ scores ($p=0.059$).

Team based results revealed that post-VH CS mean scores were higher for all teams (see Table 6, Appendix M). Eighty percent of the teams recorded higher post-VH T-TPQ scores in

MSS and SAS. The range between minimum and maximum team pre-VH and post-VH subscale mean scores was greater in the MSS. Minimum (min=1.33) and maximum (max=5) range of difference between team pre-VH and post-VH was narrower for CS, followed by SAS (min= 0, max=4). Similarly, team composite pre-VH and post-VH T-TPQ mean difference ranged from 0.17 (minimum) to 4.67 (maximum).

Differences between subscale responses for pre-VH or post-VH T-TPQ were examined based on gender, age, and military experience. While the sample size was small and scores reflected perceptions of the student's team for the VH session, a pattern was noted in responses to pre-VH Communication Subscale question 7 ("student nurses seek information from all available sources"). Despite a response mode of 4 ("agree") for both pre-VH and post-VH T-TPQ responses to CS question 7, responses were negatively ranked by gender ("strongly agree" for males and "agree" or "neutral" for females). There were no differences between subscale responses for military experience, ethnicity, or age range.

Faculty evaluations of teamwork

Post-VH T-TPQ CS responses and faculty evaluation team communication scores were examined to answer the final research question about differences existing between nursing students' perceptions of team communication and faculty evaluation of students' team communication. Ten faculty members evaluated the 20 participants who were dispersed among six teams. Missing evaluation information occurred for one team member's communication (n=19). Results indicated that faculty rated three of the six teams as having met expectations in all seven communication criteria (see Table 8, Appendix N). Fifty percent of the teams demonstrated teamwork communication needing improvement in either seeking information from all available sources, relaying information in a timely manner, or both criteria.

Discussion

Teamwork is an essential component of quality nursing care with students and expert raters in agreement that SBE has improved nursing students' team effectiveness (Reime, Johnsgaard, Kvam, et al., 2016; Coppens, 2018). Even as communication, mutual support, and situational awareness are considered significant elements of teamwork, SBE and training in "dynamic, unpredictable environments" has been considered key in the development of adaptive teams (p. 194, Gorman et al., 2016). Virtual Hospital, a novel and dynamic MPS, is an integral aspect of SBE within the ABSN program to prepare students in the transition to practice as effective healthcare providers and team members. Faculty observations have been the traditional means of evaluating teamwork in VH as part of coursework outcome assessment. This DNP project supplemented outcome assessment by measuring ABSN student perceptions of teamwork in areas of communication, mutual support, and situational awareness associated with VH participation to address an evaluation gap of learner perceptions of these critical skills. Use of the validated T-TPQ (AHRQ, 2014), before and after student participation in VH, facilitated analysis of aggregated, self-reported team data. The additional assessment of nursing students' perception of teamwork aligned with social constructivist theory and was used to guide clinical SBE integration in the ABSN curricula with consideration of research that found nursing perceptions of teamwork have been associated with quality healthcare outcomes (Manser, 2009).

While clinical teamwork opportunities were provided, in groups of three to eight students, as part of the ABSN program, VH team composition may have been dynamic. Dynamic teams, when compared to stable teams, have members that may not have had experience working with any of the other members of the team in a clinical setting. A benefit of dynamic team membership in ABSN authentic and simulated clinical settings is the opportunity to experience

some of the complexity of dynamic healthcare teams present in many areas of clinical care (Harris, Eccles, & Shatzer, 2017). Interpretation of pre-VH T-TPQ responses seemed to indicate agreement among ABSN students that previous clinical team experiences included opportunities for communication, mutual support, and situational awareness.

Despite the possibility of dynamic VH team composition confounding perception scores, all participants perceived that specific elements of teamwork were performed during VH. Moreover, the results for the post-VH T-TPQ responses indicated significant agreement of teamwork performance in communication and general agreement for both situational awareness and mutual support. These results are analogous to research by Joshi, Hernandez, Martinez, Abdel Fattah, and Gardner (2018) in which dynamic healthcare teams did display improvements in teamwork during simulated clinical scenarios. Faculty evaluations scores for VH team communication may have, at first glance, seemed to contradict student perceptions of teamwork. Another perspective is that student perceptions reinforce the value of experiential learning even as expert ratings underscore the necessity of SBE in teamwork development and application (Coppens, 2018). This view is also drawn from evidence of dynamic healthcare teams whose teamwork, but not clinical effectiveness, improved when compared to stable team improvements in both clinical effectiveness and teamwork (Joshi, Hernandez, Martinez, et al., 2018).

Finally, it is noted the there was a gender associated, perceived difference in pre-VH versus post-VH T-TPQ answers to inquiries of team performance in seeking information from all available resources, including information, equipment, and people. Combined with faculty evaluations indicating suboptimal teamwork in information seeking, attention was given to understanding the unexpected, possible influence of gender in team resource utilization and communication. Review of the literature found that significant gender communication style

differences may exist more in perceptions than actions (Cleveland, Stockdale, & Murphy, 2000). Perceived differences in the meaning of "all available resources" may then have had an impact upon female nursing students. Perceptions and intent to use technology, such as an electronic medical record (EMR), as part of the available resources have been shown to be influenced by gender (Afonso, Roldán, Sánchez-Franco, & de la Gonzalez, 2012; Goswami & Dutta, 2016; Oliveira, Souza, Pontes, Pereira, Apostolico, & Puggina, 2017). Gender, according to the theory of planned behavior (TPB), moderated both perception and intention to use technology, accounting for half of recorded variations in intention and a third of behavior variations associated with technology use (Oliveira et al, 2017). The TPB also suggests that perceptions of intention may explain the variation in pre-VH results when compared to post-VH results in contrast to another theory that gender influences patterns of seeking feedback from team members (Miller & Karakowsky, 2005).

Implications/Recommendations for Practice, Policy, and Research

Information about learner perception was integral to several goals: understanding VH's impact on nursing students' perceived teamwork, guiding curricula development, and complying with policies and standards to review outcomes associated with preparing baccalaureate degree nursing students to transition to practice (AACN, 2008). In addition, the conditions placed upon the researcher and ABSN program to conduct the quasi-experimental pilot highlighted the resources needed for a larger, experimental study. Curricular support for the teamwork practice embedded in VH was derived from nursing students' post-VH perceptions and faculty assessments of team communication, coupled with the evidence from healthcare literature about the necessity of teamwork, especially effective communication skills (Apker, Propp, Zabava-

Ford, & Hofmeister, 2006; Barton, Bruce, & Schreiber, 2017; Propp, Apker, Zabava-Ford, Wallace, Serbenski, & Hofmeister, 2010),

Recommendations are as follows:

- Continue TeamSTEPPS® or other highly reliable organization/crew resource team education within the program prior to student participation in VH.
- Retain VH within the ABSN curriculum.
- Increase student participation to two or more sessions of multi-patient SBE.
- Embed deliberate practice for seeking information from all available sources in authentic and simulated clinical settings throughout the ABSN program.
- Expand multi-patient SBE to include interprofessional collaboration prior to completion of the ABSN program.
- Continue use of validated instruments, such as the TeamSTEPPS T-TPQ (AHRQ, 2014), to assess perceptions of teamwork before and after VH.
- Use validated instruments in VH, such as the Creighton Simulation Evaluation Instrument (Adamson, Kardong-Edgren, & Willhaus, 2013), that correspond to all domains in student assessment.

Further research may be warranted on gender associated differences, particularly male perceptions of team utilization of all available resources compared to female perceptions of team utilization of all available resources. Research related to seeking information from clinical resources, equipment, and people, with a focus on technology utilization in SBE in both intra and interprofessional teams is suggested. Based on the results of the pilot, additional research is needed using validated instruments to evaluate interprofessional dynamic and stable student team outcomes in the context of multiple patient simulations.

Limitations

This pilot project is limited in the ability to draw causal relationships between participation in team SBE and specific teamwork outcomes, a result of the single site design without randomization of teams and lack of a control group. Further weaknesses stem from the small sample size, limited sample diversity, single discipline team composition, and unequitable scales between the T-TPQ communication subscale and faculty evaluation form, all contributing significant threats to validity.

Conclusions

This DNP project investigated nursing student perceptions before and after a clinical simulation involving team care of multiple patients (VH) for evaluation and curricular planning purposes. A valid instrument, the T-TPQ (AHRQ, 2014), was used to measure the student perceptions in situational awareness, mutual support, and communication. There were significant differences between the pre-VH and post-VH composite T-TPQ and pre-VH and post-VH T-TPQ communication subscale scores. Although the data indicated students perceived greater team communication after VH participation, faculty evaluations revealed that 50% of the teams would need more practice in seeking information and relaying information in a timely manner. Similar findings from research substantiate nursing students' gap in teamwork skills with significant deficiencies in communication (Hart et al., 2014). The DNP project results supported continued curriculum integration of simulated clinical teamwork experiences and concurred with findings by Lavoie, Michaud, Bélisle, Boyer, Gosselin, Grondin, et al (2018) who stressed that nursing education must expand the use of validated instruments to evaluate team SBE.

References

Adamson, K. A., Kardong-Edgren, S., & Willhaus, J. (2013). An updated review of published simulation evaluation instruments. *Clinical Simulation in Nursing*, 9e393-e405. doi:10.1016/j.ecns.2012.09.004

Agency for Healthcare Research and Quality (2014). Teamwork Perceptions Questionnaire (T-TPQ). Retrieved from https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/education/curriculum-tools/teamstepps/instructor/reference/teampercept.pdf

Aliakbari, F., Parvin, N., Heidari, M., & Haghani, F. (2015). Learning theories application in nursing education. *Journal of Education and Health Promotion, 4*(2). http://doi.org/10.4103/2277-9531.151867

Afonso, C.M., Roldán, J.L., Sánchez-Franco, M. and de la Gonzalez, M.O. (2012) The Moderator role of gender in the unified theory of acceptance and use of technology (UTAUT): A study on users of electronic document management systems. *Proceedings of the 7th International Conference on Partial Least Squares and Related Methods*, Houston.

American Association of Colleges of Nursing (2008). *The essentials of baccalaureate education for professional nursing practice*. Washington, DC, American Association of Colleges of Nursing.

American Institutes for Research (2010). *TeamSTEPPS teamwork perceptions questionnaire (T-TPQ) manual*. Washington, D.C., American Institutes for Research.

Apker, J., Propp, K.M., Ford, W.S, & Hofmeister, N. (2006). Collaboration, credibility, compassion, and coordination: Professional nurse communication skill sets in health care

team interactions. *Journal of Professional Nursing, 22*(3), p.180-189. doi:10.1016/j.profnurs.2006.03.002

Ayers, C., Binder, B.K., Lyon, K.C., Montgomery, D., Koci, A., & Foster, W.A. (2015). The simulated hospital environment: A qualitative study applying space industry techniques. *Journal of Professional Nursing*, *31*(1), 18-25.

Baker, D.P., Day, R., & Salas, E. (2006). Teamwork as an essential component of high-reliability organizations. *Health Services Research, 41*(4 Pt 2), 1576–1598. Retrieved from http://doi.org.proxygw.wrlc.org/10.1111/j.1475-6773.2006.00566.x

Barkimer, J. (2016). Clinical growth: An evolutionary concept analysis. *Advances in Nursing Science*, *39*(3), E28-E39.

Barton, G., Bruce, A., & Schreiber, R. (2017). Review: Teaching nurses teamwork: Integrative review of competency-based team training in nursing education. *Nurse Education in Practice*, doi:10.1016/j.nepr.2017.11.019

Bishop, S. & Stewart, P. (2014). Simulation: A day in the life of a pediatric nurse. *Journal of Nursing Education, 53*(3), 174-176.

Blodgett, T.J., Blodgett, N.P., & Bleza, S. (2016). Simultaneous multiple patient simulation in undergraduate nursing education: A focused literature review. *Clinical Simulation in Nursing, 12*, 346-355.

Bradbury-Jones, C., Sambrook, S. & Irvine, F. (2007). The meaning of empowerment for nursing students: a critical incident study. *Journal of Advanced Nursing*, *59*(4), 342-351.

Bright, D., Walker, W., & Bion, J. (2004). Clinical review: Outreach strategy for improving the care of the acutely ill hospitalized patient. *Critical Care, 8*, 33-40.

Cant, R.P. & Cooper, S. J., (2009). Simulation-based learning in nurse education: systematic review. *Journal of Advanced Nursing*, *1*, 3-15.

Chieh-wen, S., Yi-fang, T. & Ming-chia, C. (2010). Relationships among teamwork behavior, trust, perceived team support, and team commitment. *Social Behavior & Personality, 38*(10), 1297-1306. doi 10.2224/sbp.2010.38.10.1297.

CITI program, (2017). Human subject research content. Retrieved from https://about.citiprogram.org/en/homepage/.

Cleveland, J.N., Stockdale, M. & Murphy, K.R. (2000). *Women & men in organizations: Sex & gender issues at work*. Mahwah, NJ: Erlbaum.

Cobern, W.W. (1993). Constructivism. *Journal of Educational & Psychological Consultation*, *4*(1), 105-112.

Cook, D.A.., Brydges, R., Hamstra, S.J., Zendejas, B., Szostek, J.H., Wang A.T….Hatala, R. (2012). Comparative effectiveness of technology-enhanced simulation versus other instructional methods: A systematic review and meta-analysis. *Sim Healthcare, 7*, 308-320.

Coppens, I. (2018). The effectiveness of crisis resource management and team debriefing in resuscitation education of nursing students: A randomised controlled trial. *Journal of Clinical Nursing*, *27*(1-2), 77 -85. doi: 10.1111/jocn.13846

Cronenwett, L., Sherwood, G., Barnsteiner, J., Disch, J., Johnson, J., Mitchell, P., & ... Warren, J. (2007). Quality and safety education for nurses. *Nursing Outlook*, *55*(3), 122-131.

Davies, J., Nathan, M. & Clarke, D. (2012). An evaluation of a complex simulated scenario with final year undergraduate children's nursing students. *Collegian, 19*, 131-138.

Franklin, A.E. Sideras, S., Gubrud-Howe, P., & Lee, C.S. (2014). Comparison of expert modeling versus voice-over PowerPoint lecture and presimulation readings on novice nurses' competence of providing care to multiple patients. *Journal of Nursing Education, 53*(11), 615-622.

Frontiero, L.A. & Glynn, P. (2012). Evaluation of senior nursing students' performance with high fidelity simulation. *Online Journal of Nursing Informatics, 16*(3). Retrieved from http://ojnl.org/Issues/?p=2037

Gaba, D.M. (2004). The future vision of simulation in health care. *Quality & Safety in Health Care, 13*(S1).

Gamble, A. (2017). Simulation in undergraduate paediatric nursing curriculum: Evaluation of a complex 'ward for a day' education program. *Nurse Education in Practice, 23,* 40-47.

Gorman, J. C., Martin, M. J., Dunbar, T. A., Stevens, R. H., Galloway, T. L., Amazeen, P. G., & Likens, A. D. (2016). Cross-level effects between neurophysiology and communication during team training. *Hum Factors, 58*(1), 181-199. doi:10.1177/0018720815602575

Goswami, A. & Dutta, S. (2016) Gender differences in technology usage—A literature review. *Open Journal of Business and Management, 4,* 51-59. doi: 10.4236/ojbm.2016.41006.

Greiner, A., & Knebel, E. (2003). *Health professions education: A bridge to quality.* Washington, D.C, National Academies Press.

Hallin, K. Backstrom, B., Haggstrom, M. & Kristiansen, L. (2016). High-fidelity simulation: Assessment of student nurses' team achievements of clinical judgment. *Nurse Education in Practice 19,* 12-18.

Hansen, J., & Bratt, M. (2017). Effect of sequence of simulated and clinical practicum learning experiences on clinical competency of nursing students. *Nurse Educator*, *42*(5), 231-235. doi:10.1097/NNE.0000000000000364

Harris, K.R., Eccles, D.W. & Shatzer, J.H. (2017). Team deliberate practice in medicine and related domains: a consideration of the issues. *Advances in Health Science Education*, *22*, 209–220.

Hart, P.L., Maguire, M.R., Brannan, J.D., Long, J.M., Robley, L.R. & Brooks, B.K. (2014). Improving bsn students' performance in recognizing and responding to clinical deterioration. *Clinical Simulation in Nursing*, *10*, e25–e32. doi:10.1016/j.ecns.2013.06.00

Hertzog, M.A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health*, *31*(2), 180-191.

Hobgood, C., Sherwood, G., Frush, K., Hollar, D. Maynard, L., Foster, B.… & Taekman, J. (2010). Teamwork training with nursing and medical students: does the method matter? Results of an interinstitutional, interdisciplinary collaboration. *Quality and Safety in Health Care*, *19*, 1-6.

Horsley, T. L., Bensfield, L. A., Sojka, S., & Schmitt, A. (2014). Multiple-patient simulations. *Nurse Educator*, *39*(6), 311-315. doi:10.1097/NNE.0000000000000087

Hunt, E.A., Shilkofski, N.A., Stavroudis, T.A. & Nelson, K.L. (2007). Simulation: Translation to improved team performance. *Anesthesiology Clinics*, *25*, 301-319.

Ironside, P.M., Jeffries, P.R., & Martin, A. (2009). Fostering patient safety competencies using multiple-patient simulation experiences. *Nursing Outlook*, *57*(6), 332-337.

Jeffries, P.R., Clochesy, J.M., & Hovancsek, M.T. (2009). Designing, implementing, and evaluating simulations in nursing education. In: Billings D, Halstead J, eds. *Teaching in Nursing: A Guide for Faculty*. 3rd ed. St Louis, MO. Saunders Elsevier; 322–334.

Josephsen, J. (2013). Teaching nursing delegation: An on-line case study. *Teaching & Learning in Nursing*, *8*(3), 83-87.

Joshi, K., Hernandez, J., Martinez, J., Abdel Fattah, K., & Gardner, A. K. (2018). Should they stay or should they go now? Exploring the impact of team familiarity on interprofessional team training outcomes. *The American Journal of Surgery*, *215*(2), 43-249. doi:10.1016/j.amjsurg.2017.08.048

Joyal, K.M., Katz, C., Harder, N. & Dean, H. (2015). Interprofessional education using simulation of an overnight inpatient ward shift. *Journal of Interprofessional Care*, *29*(3), 268-270.

Kalisch, B. J., Weaver, S. J., & Salas, E. (2009). What does nursing teamwork look like? A qualitative study. *Journal of Nursing Care Quality*, *24*(4), 298-307. doi:10.1097/NCQ.0b013e3181a001c0

Kaplan, B. & Ura, D. (2010). Use of multiple patient simulators to enhance prioritizing and delegating skills for senior nursing students. *Journal of Nursing Education*, *49*(7), 371-377.

Keebler, J.K., Dietz, A.S., Lazzara, E.H., Benishek, L.E., Almeida, S.A., Toor, P.A…Salas, E. (2014). Validation of a teamwork perceptions measure to increase patient safety. *BMJ Quality & Safety*, *23*, 718-726.

Ker, J., Mole, L., & Bradley, P. (2003). Early introduction to interprofessional learning: a simulated ward environment. *Medical Education*, *37*, 248-255.

Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, D.C, National Academy Press.

Kovner, C.T., Brewer, C., Fatehi, F., & Katigbak, C. (2014). Original research: Changing trends in newly licensed rns. *American Journal of Nursing*, *114*(2), 26-34.

Lavoie, P., Michaud, C., Bélisle, M., Boyer, L., Gosselin, É., Grondin, M., & ... Pepin, J. (2018). Learning theories and tools for the assessment of core nursing competencies in simulation: A theoretical review. *Journal of Advanced Nursing*, *74*(2), 239-250. doi:10.1111/jan.13416

Lewis, R., Strachan, A., & Smith, M. M. (2012). Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *The Open Nursing Journal*, *6*, 82–89. http://doi.org.proxygw.wrlc.org/10.2174/1874434601206010082

Leonard, B., Shuhalbar, E., & Chen, R. (2010). Nursing student perceptions of intraprofessional team education using high-fidelity simulation. *Journal of Nursing Education*, *49*(11), 628-631.

Liaw, S.Y., Koh, Y. Dawood, R., Kowitlawakul, Y., Zhou, W., Lau, S.T. (2014). Easing student transition to graduate nurse: A simulated professional learning environment (simple) for final year student nurses. *Nurse Education Today*, *34*, 349-355.

Manser, T. (2009). Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. *Acta Anaesthesiologica Scandinavica*, *53*(2), 143-151. doi:10.1111/j.1399-6576.2008.01717.x

McGaghie, W.C. Issenberg, S.B., Petrusa, E.R., & Scalese, R.J. (2010). A critical review of simulation-based medical education research. *Journal of Medical Education, 44*(1), 50-63.

McGrath, M., Lyng, C. & Hourican, S. (2012). From the simulation lab to the ward: Preparing 4th year nursing students for the role of staff nurse. *Clinical Simulation in Nursing, 8*, e265-e272.

McNelis, A. M., & Ironside, P. M, (2009). National survey on clinical education in prelicensure nursing education programs. In Ard, N., & Valiga, T.M, eds. *Clinical nursing education: Current reflections*, New York, National League for Nursing.

Miller, D. L. & Karakowsky, L. (2005). Gender influences as an impediment to knowledge sharing: When men and women fail to seek peer feedback. *Journal of Psychology*, *139*(2), 101-118.

Mole, L.J. & McLafferty, I.H. (2004). Evaluating a simulated ward exercise for third year student nurses. *Nurse Education in Practice*, *4*(2), 91-99.

Motola, I., Devine, L. A., Chung, H. S., Sullivan, J. E., & Issenberg, S. B. (2013). Simulation in healthcare education: a best evidence practical guide. AMEE Guide No. 82. *Medical Teacher*, *35*(10), e1511-e1530. doi:10.3109/0142159X.2013.818632

Nestel, D. & Bearman, M. (2015). Theory and simulation-based education: Definitions, worldviews and applications. *Clinical Simulation in Nursing*, *11*, 349-354.

Nikendei, C., Huhn, D., Pittius, G., Trost, Y., Bugaj, T.J….Schultz, J.H. (2016). Students' perceptions on an interprofessional ward round training – a qualitative pilot study. *Journal for Medical Education*, *33*(2), 1-15.

Nowell, L.S. (2016). Delegate, collaborate, or consult? A capstone simulation for senior nursing students. *Nursing Education Perspectives*, *37*(1), 54-55.

Oliveira, L.M.A., Souza, E.L., Pontes, E.F., Pereira, L.L., Apostolico, M.R., Puggina, A.C. (2017). Nursing undergraduate students' motivation in the use of information and communication Technologies. *Revista Baiana De Enfermagem*, *31*(3), e17898

Patterson, M.D., Blike, G.T., & Nadkarni, V.M. (2008). In situ simulation: Challenges and results. In Henriksen K., Battles J.B., Keyes M.A., and Grady M.L. (eds): *Advances in patient safety: New directions and alternative approaches* (Vol. 3: Performance and Tools). Rockville (MD): Agency for Healthcare Research and Quality. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK43682

Pauly-O'Neill, S., Cooper, E., & Prion, S. (2016). Student qsen participation during an adult medical-surgical rotation. *Nursing Education Perspectives*, *37*(3), 165-167. doi:10.5480/14-1410

Pearson, E. & McLafferty, I. (2011). The use of simulation as a learning approach to non-technical skills awareness in final year student nurses. *Nurse Education in Practice, 11*, 399-405.

Peters, M. (2000). Does constructivist epistemology have a place in nurse education? *Journal of Nursing Education*, *39*(4), 166-172.

Powell, K.C. & Kalina, C.J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, *130*(2), 241-250.

Propp, K.M., Apker, J., Zabava-Ford, W.S., Wallace, N., Serbenski, M., & Hofmeister, N. (2010). Meeting the complex needs of the health care team: Identification of nurse–team

communication practices perceived to enhance patient outcomes. *Qualitative Health Research, 20*(1), 15-28. doi: 10.1177/1049732309355289

Quality and Safety Education for Nurses. QSEN, (2014). Retrieved from http://qsen.org/competencies/pre-licensure-ksas/

Rahn, D. J. (2016). Transformational teamwork. *Journal of Nursing Care Quality, 31*(3), 262-268. doi:10.1097/NCQ.0000000000000173

Reime, M. H., Johnsgaard, T., Kvam, F. I., Aarflot, M., Breivik, M., Engeberg, J. M., & Brattebø, G. (2016). Simulated settings; powerful arenas for learning patient safety practices and facilitating transference to clinical practice. A mixed method study. *Nurse Education in Practice, 21*, 75-82. doi:http://dx.doi.org/10.1016/j.nepr.2016.10.003

Salas, E., Wilson, K. A., Burke, C. S., & Priest, H. A. (2005). Using simulation-based training to improved patient safety: What does it take? *Joint Commission Journal on Quality & Patient Safety, 31*(7), 363-371.

Schreiber, L.M. & Valle (2013). Social constructivist teaching strategies in the small group classroom. *Small Group Research, 44*(4), 395-411.

Survey Monkey, (2017). SSL Encryption. Retrieved from https://help.surveymonkey.com/articles/en_US/kb/What-is-the-enhanced-security-option-SSL-encryption.

Ulrich, B., Krozek, C., Early, S., Ashlock, C. H., Africa, L. M., & Carman, M. L. (2010). Improving retention, confidence, and competence of new graduate nurses: results from a 10-year longitudinal database. *Nursing Economic$, 28*(6), 363-376.

Van Bogaert, P., Timmermans, O., Weeks, S.M., Vanheusden, D., Wouters, K., & Franck, E. (2014). Nursing unit teams matter: Impact of unit-level nurse practice environment, nurse

work characteristics, and burnout on job outcomes, and quality of nursing care, and patient adverse events: a cross-sectional survey. *International. Journal of. Nursing Studies*. doi: 10.1016/j.ijnurstu.2013.12.009

Van Geest, J.B. & Cummins, D.S. (2003). Educational needs assessment for improving patient safety: Results of a national study of physicians and nurses, National Patient Safety Foundation, Chicago, IL. Retrieved from http://c.ymcdn.com/sites/www.npsf.org/resource/collection/abab3ca8-4e0a-41c5-a480-6de8b793536c/Educational_Needs_Assessment.pdf?hhSearchTerms=%22Educational+and+needs+and+assessment+and+improving+and+patient%22

Appendix A

Agency for Healthcare Research and Quality (AHRQ, 2014)
TeamSTEPPS Teamwork Perceptions Questionnaire (T-TPQ)

Sample Modified TeamSTEPPS Teamwork Perceptions Questionnaire (T-TPQ)	1= strongly disagree	2= disagree	3= neutral	4= agree	5= strongly agree
Situation Awareness Subscale					
1. Student nurses anticipate each other's need.					
2. Student nurses monitor each other's performance.					
3. Student nurses exchange information as it becomes available.					
4. Student nurses continuously scan the environment for important information.					
5. Student nurses share information regarding potential complications.					
6. Student nurses meet to reevaluate care goals when situation change.					
7. Student nurses correct each other's mistakes to ensure procedures followed properly.					
Communication Subscale					
1. Information is explained to patients and their families in lay terms.					
2. Information is relayed in a timely manner.					
3. Time allowed for questions when communicating with patients.					
4. Student nurses use common terms when communicating with each other.					
5. Student nurses verbally verify information they receive.					
6. Student nurses follow standard method of sharing information.					
7. Student nurses seek information from all available sources.					
Mutual Support Subscale					
1. Student nurses request aid when they feel overwhelmed.					
2. Student nurses caution each other about potential danger.					
3. Feedback between student nurses is delivered in a way that promotes positive interactions and change.					
4. Student nurses assist peer during high workload.					
5. Student nurses advocate for patients even when their opinion conflicts with leader.					
6. Student nurses challenge others when they have concern about patient safety.					
7. Student nurses resolve their conflicts					

Appendix B

Virtual Hospital On Campus Clinical Report (OCCR)

(Print) Student:	**(Print) VH Instructor:**	
Scoring: 0 = Unsatisfactory 1 = Needs Improvement 2 = Meets expectations NA – Not applicable		
QSEN Competency/Performance Measures	**Score**	**Instructor Comments**
Patient-centered Care:		
Perform focused assessment, including pain assessment		
Organizes, prioritizes, delivers care in a timely and cost-effective manner		
Evaluates patient response to nursing care		
Provide multiple dimensions of care (examples: transition of care, preferences/values, psychosocial, family centered care)		
Teamwork and Collaboration:		
1. Information regarding patient care is explained to patients and their families in lay terms		
2. Allows enough time for questions when communicating with patients		
3. Uses common terminology when communicating with team members		
4. Seeks information from all available sources		
5. Verbally verifies information that they receive from one another		
6. Follows a standardized method of sharing information		
7. Relays relevant information in a timely manner		
Safety:		
Maintains a safe environment for patient.		
Identifies patient using 2 identifiers.		
Performs 5 rights and 3 checks of med. Admin.		
Demonstrates appropriate use of PPE, infection control measures, hand hygiene, sterile procedures and prevention of HAI.		
Evidenced- based Practice:		
Uses mobility/repositioning to promote skin integrity and comfort.		
Use or adapt evidenced based guidelines for assessment of pain/ fall risk		
Quality Improvement:		
Identify nursing quality indicator(s)		
Informatics:		
Employ communication technology to coordinate care for patients (recorded report, phone calls). Protect information in I.		
Professionalism:		
Maintains professional behavior and appearance according to school policy.		

Appendix C

Table 1. Variable descriptions and definitions

Variable Name	Variable Type and Form	Theoretical/Descriptive Definition	Operational Definition
Total score of perception of teamwork performance	Dependent/ Interval Count	The ability of a team to carry out shared decision making and goals/The total score from three scales of team performance	T-TPQ Sum of three scales of team performance. Each scale has seven questions, scored on a scale of 1-5 1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree
Perception of teamwork performance: Communication scale	Dependent /Interval Count	Form of communication between a sender and a receiver/Respondent total score about team communication	T-TPQ Sum of seven questions 1. Information is explained to patients and their families in lay terms. 2. Information is relayed in a timely manner. 3. Time allowed for questions when communicating with patients. 4. Student nurses use common terms when communicating with each other. 5. Student nurses verbally verify information they receive. 6. Student nurses follow standard method of sharing information. 7. Student nurses seek information from all available sources.
Perception of teamwork performance: Mutual support scale	Dependent /Interval Count	Provision of task assistance and feedback about current performance to one or more team members/Respondent total score about team mutual support	T-TPQ Sum of seven questions 1. Student nurses assist peer during high workload. 2. Student nurses request aid when they feel overwhelmed. 3. Student nurses caution each other about potential danger.

			4. Feedback between student nurses is delivered in a way that promotes positive interactions and change. 5. Student nurses advocate for patients even when their opinion conflicts with leader. 6. Student nurses challenge others when they have concern about patient safety. 7. Student nurses resolve their conflicts
Perception of teamwork performance: Situation awareness scale	Dependent /Interval Count	Continuous monitoring of the environment with assessment updates shared among team members / Respondent total score about team situation awareness	T-TPQ Sum of seven questions 1. Student nurses anticipate each other's need. 2. Student nurses monitor each other's performance. 3. Student nurses exchange information as it becomes available. 4. Student nurses continuously scan the environment for important information. 5. Student nurses share information regarding potential complications. 6. Student nurses meet to reevaluate care goals when situation change 7. Student nurses correct each other's mistakes to ensure procedures followed properly.
Team Simulation activity	Independent/ Binary	An intervention that represents realistic clinical environment for interactive group learning / Nursing student teamwork in simultaneous care of multiple simulated hospital patients	0 = pre-intervention 1= post intervention
Age	Demographic/ Explanatory	The years a person has lived / Age as defined	Student age in years 1 = 18-28

	Interval count	by current date minus birth date in years	2 = 29-39 3 = 40-50 4 = 51+
Gender	Demographic/ Explanatory Binary	Biologic determinant / Participant gender	0= Male 1= Female
Military Experience	Demographic/ Explanatory Binary	Status of membership in United States Armed Forces/Past or present service in any branch of the United States Armed Forces	0= No 1= Yes
Total score for Virtual Hospital Teamwork and Collaboration	Dependent /Interval Count	The ability of the team to communicate and carry out shared goals/The total sum from teamwork and collaboration scale	The VH report form has seven questions for teamwork and collaboration, scored on a scale of 0-2 0= unsatisfactory 1= needs improvement 2= satisfactory
Teamwork and Collaboration scale	Dependent /Interval Count	The ability of the team to communicate and carry out shared goal	The VH OCCR has seven questions for teamwork and collaboration 1. Information regarding patient care is explained to patients and their families in lay terms 2. Allows enough time for questions when communicating with patients 3. Uses common terminology when communicating with team members 4. Seeks information from all available sources 5. Verbally verifies information that they receive from one another 6. Follows a standardized method of sharing information 7. Relays relevant information in a timely manner
Ethnicity	Demographic/ Explanatory Interval Count	Identification with a group that shares a common and	1. American Indian or Alaska Native 2. Asian

		distinctive culture, religion, language, or similar traits.	3. Black or African American 4. Native Hawaiian or another Pacific Islander 5. White

Appendix D

Sample Demographic Data Collection Worksheet

Student Nurse Unique Identifier	Team Assignment A=1 B=2 C=3 D=4 E=5 H = 6	Gender 0= Male 1= Female	Military experience 0= No 1= Yes	Student age in years 1 = 18-28 2 = 29-39 3 = 40-50 4 = 51+	1 = American Indian or Alaska Native 2 = Asian 3 = Black or African American 4 = Native Hawaiian or another Pacific Islander 5 = White
bsn01					
bsn02					
bsn03					
bsn04					
bsn05					
bsn06					
bsn07					
bsn08					
bsn09					
bsn10					
bsn11					
bsn12					
bsn13					
bsn14					
bsn15					
bsn17					
bsn18					
bsn19					
bsn20					
bsn21					

Appendix E

Sample Aggregate Survey Response Worksheet

Student Nurse Unique Identifier	Team simulation activity 0 = pre-intervention 1= post intervention	Total score of T-TPQ Mean of 3 subscales of team performance	Communication subscale mean of response to7 questions	Mutual support subscale mean of response to7 questions	Situation awareness subscale mean of response to7 questions
bsn01					
bsn01					
bsn02					
bsn02					
bsn03					
bsn03					
bsn04					
bsn04					
bsn05					
bsn05					
bsn06					
bsn06					
bsn07					
bsn07					
bsn08					
bsn08					

Appendix F
Written Consent Form

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Informed Consent for Participation in a Research Study

***Title of research study*:** A Study of Nursing Student Perceptions of Teamwork Performance

Investigators: *Karen Wyche, PhD and Christine Seaton, MSN*

Why am I being invited to take part in a research study?
We invite you to take part in a research project because you are part of a GWU School of Nursing student group that is scheduled for the Virtual Hospital clinical simulation during the last semester of your nursing program. Participants in the research project will be asked to complete a short survey about their perceptions of group nursing teamwork performance before and after Virtual Hospital.

What should I know about a research study?

- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Who can I talk to?
If you have questions or concerns, contact the research team at 45085 University Drive, Innovation Hall, Suite 201, Ashburn, VA, 20147. This research is being overseen by an Institutional Review Board ("IRB"). You may talk to them at 202-994-2715 or via email at ohrirb@gwu.edu if:

- Your questions or concerns are not being answered by the research team.
- You have questions about your rights as a research subject.

Why is this research being done?
The research surveys are useful in understanding perceptions of group teamwork performance, including communication, mutual support, and situation monitoring skills. These findings will help teachers determine the effectiveness of simulated team care upon nursing students' perceived teamwork performance.

How long will I be in the study?
We expect that you will complete the survey in 10 minutes or less before your Virtual Hospital session and complete the same survey again in 10 minutes or less after your Virtual Hospital

session. The Virtual Hospital session takes about 4 hours and is scheduled by the GWU School of Nursing.

What happens if I agree to be in this research?
A signed copy of this consent form will be given to you. You will be given a confidential survey identifier to complete survey responses. You will not be asked to give your name or personal information, other than your gender, age, military experience, and ethnicity when you complete the survey. You will be provided survey links and mobile devices (Ipad) to access the Survey Monkey site before and immediately after Virtual Hospital. The online survey will have three sections: communication, mutual support, and situation monitoring. Each section will have seven questions. It is estimated that the survey will take less than 10 minutes to complete. Anonymous survey scores will be totaled and examined for differences between before and after simulation scores and for differences between faculty assessment results. The analysis and comparison of group scores and differences will be shared at research poster events and publications. No individual survey findings will be presented because all the data will be aggregated.

What other choices do I have besides taking part in the research?
Instead of being in this research study, you can perform in the simulation activity without completing the teamwork surveys.

Is there any way being in this study could be bad for me?
The risks and discomforts associated with participation in this study are not greater than those ordinarily encountered in daily life or during the performance of routine questionnaires about thoughts and beliefs. Privacy risks may occur if research data stored on the internet site Survey Monkey is involved in a cybersecurity breach or if protection of survey identifiers connected to responses is not maintained securely during the project.

Will being in this study help me in any way?
You will not receive any benefits from participating in this research.

What happens to the information collected for the research?
To the extent allowed by law, we limit your personal information to people who have to review it. We cannot promise complete secrecy. The IRB and other representatives of the organization may inspect and copy your information.

Signature Block for Adult
Your signature documents your permission to take part in this research.

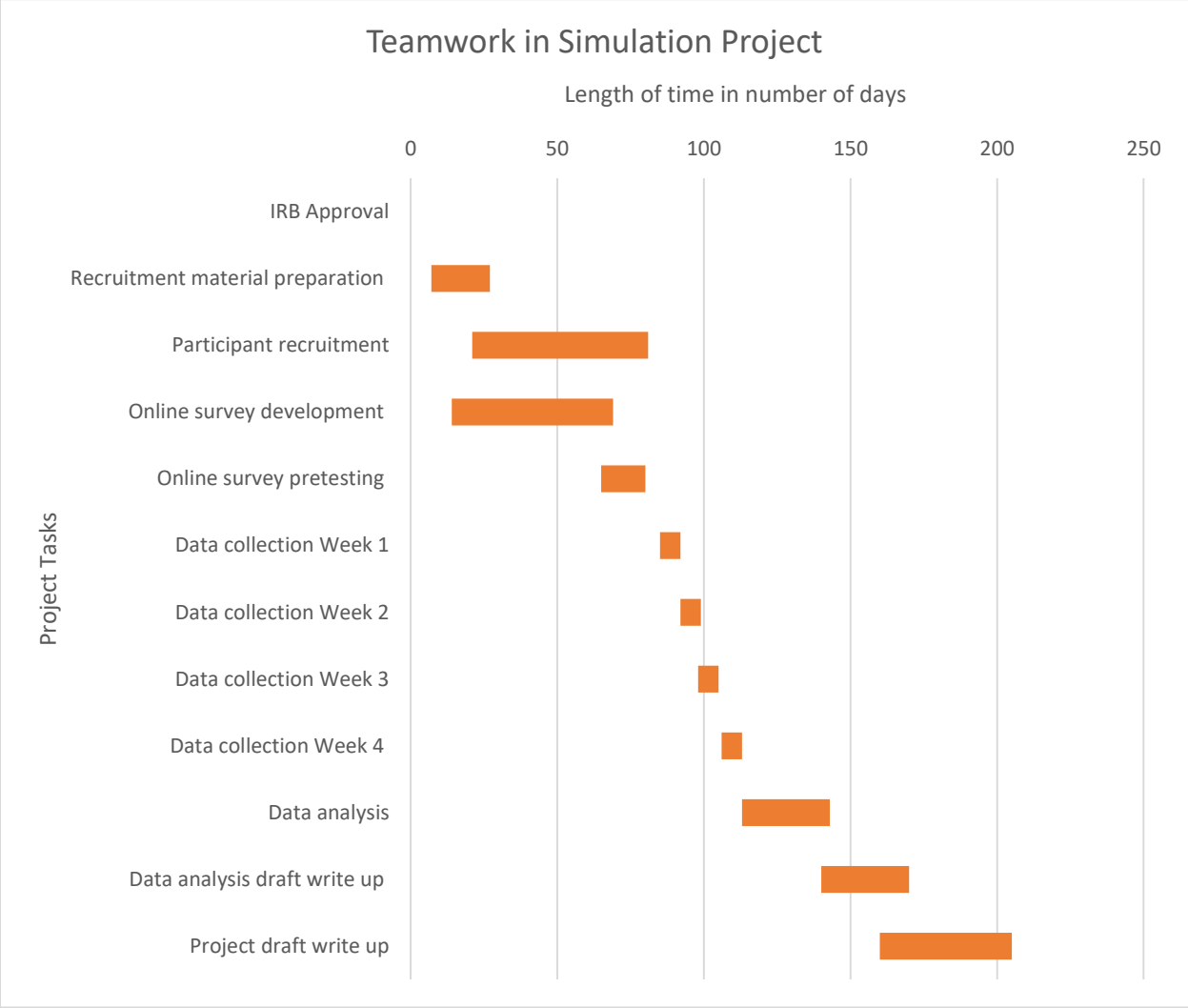
_____
Printed name of subject

_____ _____
Signature of subject Date

_____ _____
Signature of person obtaining consent Date

Appendix G

Gantt Chart



Appendix H
Recruitment Flyer

VOLUNTEER
GEORGE WASHINGTON UNIVERSITY (GWU) NURSING STUDENTS WANTED FOR A RESEARCH STUDY

A Study of Nursing Student Perceptions of Teamwork Performance

Are you a GWU nursing student in the last semester of your accelerated BSN program and registered for your capstone course (NURS 4120)? We are conducting a research study about nursing student perceptions of teamwork before and after completing the Virtual Hospital simulation clinical.

The purpose of the survey will help to guide development of learning experiences in teamwork and simulation in the School of Nursing and we are looking for your input!

The survey should take about 10 minutes to complete before your scheduled Virtual Hospital session and another 10 minutes afterwards. Students will not receive compensation for participation in the study. Your decision about participation will not affect your clinical placement or course evaluation. You do not have to give your name or personal identification to answer the survey.

Please contact Christine Seaton at cdseaton@gwu.edu for additional information.
This research is conducted under the direction of Dr. Karen Wyche, GWU SON. (IRB number)

Appendix I

Sample Recruitment E-mail

Dear Student,

You are scheduled for the Virtual Hospital clinical simulation exercise this semester. Please consider participating in the study using the TeamSTEPPS® Perception of Teamwork Questionnaire which was explained on the first day of your capstone class, NURS 4120. The Virtual Hospital Teamwork Survey can be completed before and after your Virtual Hospital session in the survey room located in the Skills and Simulation Lab.

You will be able to choose an anonymous study identity number when you enter the survey room. The online survey is accessed through links available on dedicated laboratory mobile devices and takes about ten minutes to complete each time. Your study identifier will help to keep the before Virtual Hospital and after Virtual Hospital survey responses linked together. Thank you for considering participating in this project!

Best regards
Christine Seaton

Appendix J

Table 2. Demographic Characteristics

Variables	N	Valid Percent
Gender		
Male	2	10
Female	18	90
Age		
18-28 years	12	60
29-39 years	6	30
40-50 years	2	10
51+ years	0	0
Military Experience		
Yes	1	5
No	19	95
Ethnicity		
Asian	1	5
Black or African American	1	5
Native Hawaiian or another Pacific Islander	1	5
White	17	85

Appendix K

Table 3. T-TPQ Aggregate Subscale and Composite Descriptive Statistics

Scale	N	Mean	SD	SE
Pre-VH SAS	6	27.96	1.833	0.748
Post-VH SAS	6	29.83	2.467	1.007
Pre-VH CS	6	27.42	1.915	0.782
Post-VH CS	6	29.93	2.845	1.162
Pre-VH MSS	6	26.9	3.351	1.368
Post-VH MSS	6	30.07	2.811	1.148
Pre-VH TTP Composite	6	27.43	2.295	0.937
Post-VH TTP Composite	6	29.94	2.622	1.07

Figure 1. Pre-VH T-TPQ Mean

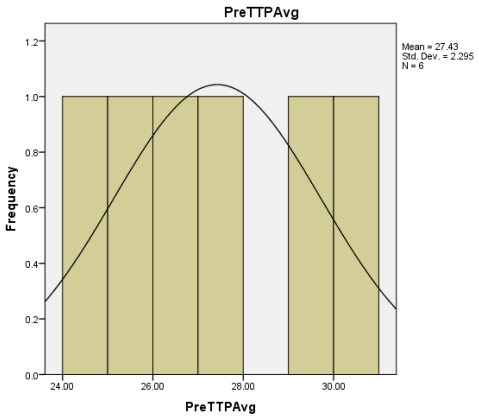
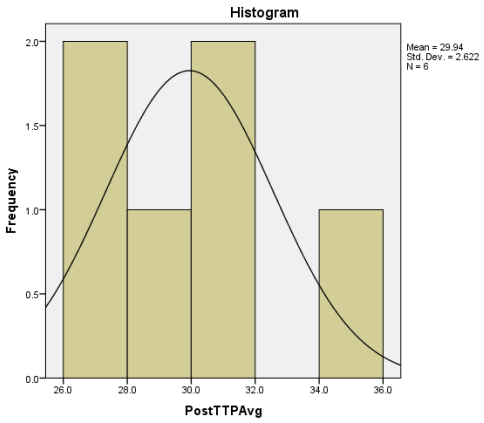


Figure 2. Post-VH T-TPQ Mean



Appendix L

T-TPQ Subscale and Composite Analysis of Pre-and Post-VH Aggregated data

Table 4. Wilcoxon Signed-Ranks Test

Variables		N	Mean Rank	Sum of Ranks
PreTTPAvg – PostTTPAvg	Negative Ranks	6[a]	3.50	21.00
	Positive Ranks	0[b]	.00	.00
	Ties	0[c]		
	Total	6		
PreCSAvg – PostCSAvg	Negative Ranks	6[j]	3.50	21.00
	Positive Ranks	0[k]	.00	.00
	Ties	0[l]		
	Total	6		

a. PreTTPAvg < PostTTPAvg
b. PreTTPAvg > PostTTPAvg
c. PreTTPAvg = PostTTPAvg
j. PreCSAvg < PostCSAvg
k. PreCSAvg > PostCSAvg
l. PreCSAvg = PostCSAvg

Scale		**P**
Pre-VH Situation Awareness Subscale (SAS) Mean[a]	Post-VH Situation Awareness Subscale (SAS) Mean	0.059
Pre-VH Mutual Support Subscale (MSS) Mean[a]	Post-VH Mutual Support Subscale (MSS) Mean	0.059
Pre-VH Communication Subscale Mean[a]	Post-VH Communication Subscale Mean	0.034**
Pre-VH T-TPQ Composite[a]	Post-VH T-TPQ Composite	0.031**

Table 5. Significance Results of the Wilcoxon Signed-Ranks test
a. Exact figures
b. **p < 0.05

Appendix M

Table 6. Team Subscale and Composite Pre-VH and Post-VH T-TPQ Mean Differences

Team	Situational Awareness	Mutual Support	Communication	Composite T-TPQ
1	0.00	0.00	2.00	0.17
2	0.33	3.34	1.33	1.67
3	1.5	3.75	2	2.42
4	1.75	2.00	2.00	1.91
5	4.00	7.25	2.75	4.67
6	3.67	2.67	5.00	3.78

Table 7. Team T-TPQ CS Mean Scores/ Faculty Mean Scores of Communication

Team	Communication Subscale Mean		Faculty Mean Score of Team Communication
	Pre-VH T-TPQ	Post-VH T-TPQ	
1	29	31	2[a]
2	28	29.33	1.95[b]
3	25.25	27.25	2[a]
4	25.5	27.5	1.97[b]
5	26.75	29.5	1.86[b]
6	30	35	2[a]

a. 2=Meets expectations
b. 1=Needs improvement

Appendix N

Table 8. Total Number of Faculty Evaluations of Team Communication Criteria

Virtual Hospital OCCR: Teamwork Communication Criteria	% Teams Met Expectations
Information regarding care explained to patients and families in lay terms	100
Allows enough time for questions when communicating with patients	100
Uses common terminology when communicating with team members	100
Seeks information from all available sources	50
Verbally verifies information that they receive from one another	100
Follows a standardized method of sharing information	100
Relays relevant information in a timely manner	50