NURSING STUDENT PERCEPTIONS OF THE EFFECTS OF INTERPROFESSIONAL COMMUNICATION AND TEAMWORK ON TIME TO RESCUE

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by

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NURSING STUDENT PERCEPTIONS OF THE EFFECTS OF INTERPROFESSIONAL COMMUNICATION AND TEAMWORK ON TIME TO RESCUE

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ABSTRACT

Simulation has been used in healthcare and other industries for many years. Advances in technology have made simulation a feasible teaching/learning pedagogy for undergraduate nursing students. Healthcare delivery continues to evolve and patient care provided by a team of professionals has emerged as one of the best ways to positively impact patient outcomes. While simulation and interprofessional education research is established in multiple healthcare disciplines, their effects on patient outcomes has not been thoroughly studied. The simulation scenario for this research study was designed to replicate an acute exacerbation of chronic obstructive pulmonary disease and associated anxiety in a simulated patient. This study will add to the science of nursing by exploring the effects of interprofessional communication and teamwork on time to rescue a simulated patient.

Keywords: simulation, interprofessional education, interprofessional communication, teamwork, nursing students, time to rescue

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Nursing and Health Studies have examined a dissertation titled "Nursing Student Perceptions of the Effects of Interprofessional Communication and Teamwork on Time to Rescue,' presented by Deborah Ann Race, candidate for Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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DEDICATION

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CHAPTER 1

INTRODUCTION

Interprofessional education (IPE) in professional healthcare education is not yet ideal and is understudied. Despite decades of recommendations encouraging IPE for healthcare professionals, education is often delivered in unilateral silos (Institute of Medicine [IOM], 1972; Institute of Medicine [IOM], 1999; Poore, Cullen, & Schaar, 2014). This 'silo phenomenon' presents a barrier to IPE (Jardine, 2020). With patient lives and safety in the balance, effective communication and teamwork among healthcare professionals are critical skills that need to be acquired, practiced, and implemented in daily clinical practice (Papa, n.d.; Rosen et al., 2018). Interprofessional simulation education (IPSE) emerged as a method to provide opportunities for healthcare professional students to safely learn and test direct care skills without placing actual patients at risk (Ferri et al., 2018; Garbee et al., 2013; Hood, Cant, Leech, Baulch, & Gilbee, 2014; Lewis, Strachan, & Smith, 2012).

Failure to rescue is a process disseminated in nursing literature for at least a decade (Mushta, Rush, & Andersen, 2017). Failure to rescue was originally used as an outcome measure of hospital quality, but has evolved as a process to assess nursing care delivery (Mushta et al., 2017). Nursing students are often not afforded opportunities to acquire essential clinical reasoning skills that assess and monitor for ambiguous patient health changes that may result in failure to rescue and poor patient outcomes (Herron, 2017).

Terminology

The International Nursing Association for Clinical Simulation and Learning (INACSL) published guidelines to clarify terminology and best practices for healthcare simulation. These terms and abbreviations can be seen throughout the literature related to IPE and interprofessional simulation education (IPSE). Consistency in the use of terminology can assist disciplines understand how IPE and IPSE relates to their particular educational curriculum.

Simulation

A realistic situation used to provide opportunities for innovative ways for students to practice skills, techniques, communication, problem solving, and critical thinking in a safe environment (Maran & Glavin, 2003). “An educational strategy in which a particular set of conditions are created or replicated to resemble authentic situations that are possible in real life” (INACSL Standards Committee, 2016, p. S44). Information technology, including the use of increasingly realistic simulators, has continued to advance year after year (Laerdal, 2014). Because of these advances, “simulation has become an increasingly effective tool in traditional science and engineering practices” ("Simulation-based Engineering Science," 2006, p. 4). Healthcare simulation “has begun to share much with established methods in aviation, spaceflight, nuclear power, shipping and the military” ("About Simulation," 2016, para. 11).

Fidelity

The term fidelity refers to the degree of realism provided by a simulation (Walker & Thrasher, 2013). “The degree to which a simulated experience approaches reality; as fidelity increases, realism increases. The level of fidelity is determined by the environment, the tools and resources used, and many factors associated with the participants” (INACSL Standards Committee, 2016, p. S42).

High-fidelity simulation (HFS)

A simulation using computer-enhanced manikins which can be programmed to resemble real life patients and situations (Solnick & Weiss, 2007). High-fidelity simulation can also be defined as a "replicated clinical experience using a computer-driven, full-bodied simulator with physiologic responses to interventions" (Onello & Regan, 2013, para. 2).

Medium fidelity simulation (MFS)

Medium fidelity simulators give a semblance of reality with features including pulse, heart sounds, and breath sounds. The simulators do not have the ability to talk and they have no chest or eye movement. They can be used for specific, increasingly complex competencies beyond what a low-fidelity simulator can offer (Al-Elq, 2010).

Low-fidelity simulation (LFS)

Low-fidelity simulations allow students to practice and improve efficiency with psychomotor skills (Onello & Regan, 2013). Performance of basic skills and tasks such as intravenous catheter insertion or positioning a manikin in bed are examples of low-fidelity simulations.

Interprofessional education (IPE)

Two or more professions learning about, from, and with each other to enable effective collaboration and improve health outcomes (Decker, 2014; WHO, 2010). Interprofessional education can stand alone or if learning occurs in a simulated environment, simulation can be included in the phrase. Interprofessional is an approach to work and learning that requires integration and collaboration to incorporate the perspectives of more than one profession (Failla & Macauley, 2014).

Simulation-enhanced interprofessional education (Sim-IPE)

Participants and facilitators from two or more professions are involved in a simulated healthcare scenario to achieve shared objectives (Decker, 2014; Failla & Macauley, 2014). In these situations, it is important to provide high-quality simulation scenarios to meet the needs of all professions involved. Simulation-enhanced interprofessional education (Sim-IPE) is a term used for the first time in the literature in 2014, (Decker, 2014). This most recent term demonstrates that terminology related to IPE and simulation continues to evolve.

Simulation in Nursing

Simulation in nursing originated in the early 1900s at the Hartford Hospital Training School in Hartford, Connecticut. Mrs. Martha Chase and her husband created a life-sized mannequin in 1911, aptly named Mrs. Chase, which was used for demonstration purposes and as a substitute for a real patient ("Simulation in Nursing Education," n.d.). Eighteen years later, in 1929, Ed Link introduced a flight simulator for the aviation industry (Bland, Topping, & Wood, 2011; Sexton, Stobbe, & Lessick, 2012). It would appear simulation education in nursing was years ahead of other industries.

Asmund Laerdal developed Resusci-Anne in the early 1960s as a simulated patient to teach medical students mouth-to-mouth resuscitation (Nickerson & Pollard, 2010). Building on the prior work of Asmund Laerdal, Sim One was developed by the Sierra Engineering and Aerojet General Corporation in the mid-1960s (Bland et al., 2011; Sexton et al., 2012). High cost and low demand led to discontinuing production of Sim One. In the 1980s two anesthesia simulators, Comprehensive Anesthesia Simulation Environment (CASE) and Gainesville Anesthesia Simulator (GAS) were created (Sexton et al., 2012). These medium-fidelity simulators were thought to demonstrate high-level technological advances at the time.

Over the last decade, HFS have elevated the level of realism in the simulation environment. In the early 2000s, concerns about patient safety and cost efficiency led to an increased focus on simulation and self-directed learning as a way to train healthcare providers. SimMan is the most durable and user-friendly patient simulator used today (*Laerdal*, 2014).

Computerized life-sized manikins provide HFS opportunities for students to practice a wide variety of simulated scenarios in a safe environment ("Simulation in Nursing Education," n.d.).

Scenarios using HFS can be developed to replicate real-life patient conditions. Heart and lung sounds, vital signs, and cardiac rhythms can be manipulated by the facilitator to mimic expected assessment criteria related to the scenario. The manikins can be programmed to appear cyanotic, bleed, cough, have a seizure, and even deliver a baby. The simulated patient can communicate with students using pre-programmed words and phrases or by voice-over technology in which the facilitator speaks through a microphone into the simulation room. The manikin can react physiologically through computer control by the instructor as students interact with the manikin and intervene for condition changes. Scenarios can be designed to simulate clinical situations the student might not encounter prior to graduation. These types of simulation scenarios are beneficial as they allow students to practice interventions without risk to actual patients (Jeffries, 2012). Videotaping included in HFS scenarios allows participants to view their actions and receive feedback from the facilitators during the debriefing process.

Simulation settings provide an environment in which students from multiple professional healthcare programs can participate together. Simulation scenarios can be designed to allow each discipline to function within their own role and scope of practice. While learning their own roles, students can observe other disciplines and learn how each works together toward the goal of providing safe patient care.

Interprofessional Education

While simulation education has been embedded in nursing education for over a century, it has become evident that the addition of IPE is necessary to keep pace with changes in the way healthcare delivery is practiced (Wang, Shi, Bai, Zheng, & Zhao, 2015). Technology has changed the way healthcare education can be taught; however actual delivery of IPE has not kept pace with those changes (Lateef, 2010). Healthcare is not provided by one discipline alone. Healthcare professionals come together in clinical settings to collaborate with each other to deliver the best possible care in a safe manner (Williams & Song, 2016).

The importance of IPE for undergraduate nursing, medicine, and allied healthcare professionals has been documented for over 40 years. The Institute of Medicine (IOM) began recommending interdisciplinary education for health teams in 1972. Members of major health professions met to address issues in healthcare education. In 1999, in response to publicized reports of patient errors, the IOM issued the *To Err is Human: Building a Safer Health System* report. The report recommended establishment of “interdisciplinary team training programs for providers that incorporate proven methods of team training” (IOM, 1999, p. 14).

Fifteen years after the 1999 IOM recommendation, Alinier, et al. (2014) posited health education continued to be delivered in silos which do not depict the reality of clinical practice. Health education in silos was cited by Poore and associates (2014) as a reason graduates lack interprofessional communication and teamwork skills as they enter the workforce. The realization that healthcare education needs to move out of discipline-specific programs and into interprofessional training is seen repeatedly in the literature (Labrague, McEnroe-Pettite, Fronda, & Obweidat, 2018; Reising, Carr, Shea, & King, 2011; Rossler & Kimble, 2016; Thibault, 2011; Wagner, Liston, & Miller, 2011; Wang, Shi, Bai, Zheng, & Zhao, 2015; Wilcox, Miller-Cribbs, Kientz, Carlson, & DeShea, 2017). Moving health professional education out of so-called silos should assist educational institutions meet the IPE recommendations which have been known for decades.

One would expect with repeated recommendations for IPE over the years and research to support integrating IPE into healthcare curricula it would be more commonplace (Stewart, 2018). However, this is not the case. Poore et al. (2014) concluded starting IPE early in the educational process gives students ample time to learn roles of the team members and practice interpersonal skills of communication and teamwork before being thrust fully into the role of a team member after graduation. Alinier, et al. (2014) reported even limited IPSE was beneficial to students. Interprofessional education scenarios implemented throughout the curricula of nursing, medicine, and allied healthcare professional students would offer multiple opportunities to practice communication and teamwork prior to graduation.

Future healthcare professionals should be prepared to work in the clinical setting as a member of an interprofessional (IP) team. The *Essentials of Baccalaureate Education for Professional Nursing Practice* issued by the American Association of Colleges of Nursing (AACN) in 2010 included recommendations for IP communication of graduate baccalaureate nurses. Inherent in the leadership expectations are "using mutually respectful communication and collaboration within interprofessional teams (American Association of Colleges of Nursing [AACN], 2010, p. 14).

The use of IPE is recognized as vital to healthcare education to prepare clinicians to become effective team members and leaders in clinical practice (Bandali, Parker, Mummery, & Preece, 2008). Simulation scenarios have become viewed as an acceptable method to introduce students to IPE and enables acquisition of IP skills (Buykx et al., 2012). Simulation in healthcare education is becoming an accepted method to bring students from multiple disciplines together in a safe environment to practice interpersonal skills such as communication and teamwork (Endacott et al., 2014).

Communication and Teamwork

Modern healthcare continues to evolve and now includes multiple disciplines coming together to provide patient care. It is important for members of healthcare teams to communicate with each other to ensure each patient receives optimal and safe care. Often, healthcare students lack training and practice of these non-technical skills prior to graduation (Turrentine et al., 2016). Yet, these same students are expected to be a functioning member of a healthcare team upon graduation (Rossler & Kimble, 2016). Interprofessional education has the potential to produce a practice-ready healthcare team that is ready to meet patient's needs (WHO, 2010).

The professional nurse's role is a vital one in recognizing and intervening when a patient's condition changes. Learning strategies such as recognition of early symptom indicators, communication, and teamwork can move the process from failure to rescue to safe patient care and improved patient outcomes (Mushta et al., 2017). The amount of time for recognition and move to appropriate intervention can be the difference between good patient outcomes and poor patient outcomes.

Conclusion

Simulation has been used in various forms in healthcare education for many years. As technology increases, so does the way simulation can be used in modern day healthcare education. Simulation provides an environment for professional healthcare students to practice technical and interpersonal IP skills as a team. Patients are not harmed in a simulated setting. Students can practice skills multiple times to improve their techniques and behaviors. Simulation and IP terminology has evolved along with technological advances in education. Exposure to challenging high-risk scenarios, no harm to real patients, learning to recognize symptom changes, and evaluation of student performance are distinct advantages of simulation and IPE.

CHAPTER 2

REVIEW OF THE LITERATURE

Professions such as aviation, business, the military, and disaster response teams practice in simulated situations before moving into real world situations. Why then should professional healthcare students not practice interprofessional (IP) skills in a simulated environment before caring for real patients in the clinical setting? Professional organizations and agencies have recommended interprofessional education (IPE) for years as a way to better prepare healthcare professionals to meet the dynamic healthcare needs of patients (American Association of Colleges of Nursing, 2014; Association of American Medical Colleges, 2012; Institute of Medicine [IOM], 1972; Nagelkerk, Coggan, Pawl, & Thompson, 2017; World Health Organization [WHO], 2010). Simulation has become an accepted way to teach skills to undergraduate professional healthcare students in a safe environment (Alinier et al., 2014). The addition of simulation to IPE allows opportunities for interprofessional healthcare students to learn with and from each other while providing safe patient care.

Mariani and Doolen (2016) acknowledged the fact that simulation in academia has expanded as demonstrated by the sheer number of simulation-related research studies in the literature over the last 10 years. However, there continues to be a gap in the science that speaks to simulation being a preferred teaching and learning pedagogy (Mariani & Doolen, 2016). Caring for patients in a safe manner is a priority in the nursing profession (Rutherford-Hemming & Jennrich, 2013). Nursing students are expected to learn the skills and techniques needed to provide safe care while in their nursing programs. Academia has access to a way to teach students how to provide care that is not only safe, but can be used across disciplines, and could yield the added benefit of improved patient outcomes. This teaching method is through simulation. Reese, Jeffries, and Engum (2010) proposed simulation was a teaching modality that would be effective in an IP learning environment. Simulation scenarios can be developed involving multiple disciplines where participants can function in the roles they will assume after graduation. By including an IP component in simulation education, students have the opportunity to experience and practice skills, such as communication and teamwork, prior to being expected to function as a team member with real patients in a clinical setting (Lateef, 2010; Wang, Shi, Bai, Zheng, & Zhao, 2015; Williams & Song, 2016).

Regulatory Agencies

Interprofessional education was identified by the Institute of Medicine (IOM) in 1972 as having multiple benefits to healthcare education. The IOM identified the need to provide "interdisciplinary education, the value of clinical settings for developing interdisciplinary education, and then the need for governmental and professional support of interdisciplinary education for health delivery teams" (IOM, 1972, p. 1). Some of the expected benefits were that healthcare would be efficient, effective, comprehensive, and personalized (IOM, 1972). Since that initial report, the IOM has continued to recommend and support IPE as a way to move healthcare education forward with the ultimate goal of providing safe care and improving patient outcomes (Rutherford-Hemming & Jennrich, 2013; IOM, 1999; Institute of Medicine [IOM], 2015).

Joint accreditation has been in place since 2009 for the disciplines of medicine, pharmacy, and nursing (EMS Medical, 2018). According to the Joint Accreditation for Interprofessional Continuing Education website (2018), 73 organizations are listed as having met eligibility requirements. Eligibility requirements for joint accreditation according to EMS Medical (2018) are:

> … an organization needs to demonstrate that for the previous 18 months its structure and processes to plan and present education by and for the healthcare team have been fully functional; and that at least 25% of its educational activities have been designed by and for healthcare teams. In addition, the organization must demonstrate compliance with the Joint Accreditation criteria. (para. 4)

The Interprofessional Education Collaboration (IPEC) developed competencies for IPE which were published in a 2011 report and were retained in a 2016 update. Two of the four competencies are interprofessional communication practices and interprofessional teamwork and team-based practices (Interprofessional Education Collaborative [IPEC], 2016). These competencies could be implemented to assist students in meeting curricular goals of learning to communicate with other healthcare team members and performing as a vital member of the team, thus contributing to positive patient outcomes after graduation (Keshtkaran, Sharif, & Rambod, 2014).

When there is a lack of communication and ineffective teamwork the risk of patients receiving poor medical care is increased and mistakes are made (Joint Commission, 2014; Stewart, 2018; World Health Organization [WHO], 2010). The American Association of Colleges of Nursing (AACN) and the WHO have identified IPE as having benefits; specifically a reduction of patient errors (American Association of Colleges of Nursing [AACN], 2010; WHO, 2010). The World Health Organization (WHO) (2010) concluded after "50 years there is now enough evidence to indicate that interprofessional education enables effective collaborative practice which in turn optimizes health-services, strengthens health systems and improves health outcomes" (p. 18). Despite these recommendations, there has been little evidence in the literature showing nursing or allied health professional students consistently participating in IPE.

Interprofessional Education Accreditation

"Most undergraduate and post-graduate programs provide only limited educational opportunities for intentionally designed interactions with students of other disciplines" (National League for Nursing [NLN], 2010, p. 2). The number of professional healthcare education programs including IPE was expected to increase after early 2018 when inclusion of IPE in program curricula becomes an expectation for schools of pharmacy, medicine, dentistry, nursing, and physical therapy to be eligible for accreditation (Stockert & Ohtake, 2017). The Joint Accreditation for Interprofessional Continuing Education offers organizations the ability to receive accreditation to "provide medical, physician assistants, nursing, pharmacy, and optometry continuing education through a single, unified application process, fee structure, and set of accreditation standards" (Joint Accreditation for Interprofessional Continuing Education website, 2018, para. 1). This group establishes the standards for continuing IPE planned for the healthcare team.

Nursing

The position statement of the American Association of Colleges of Nursing (AACN) included recommendations for IPE in general and in particular, communication and teamwork (American Association of Colleges of Nursing, 2010). Interprofessional education is part of the strategic plan of the AACN (American Association of Colleges of Nursing website, 2018). The American Nursing Credentialing Center (ANCC) is a member and co-founder of the Joint Accreditation for Interprofessional Continuing Education (EMS Medical, 2018; Joint Accreditation for Interprofessional Continuing Education website, 2018). Nursing organizations such as the National League of Nursing (NLN) and the AACN recognize and support IPE and simulation as means to provide future nurses the best opportunities to be more practice ready at the time of graduation (American Association of Colleges of Nursing website, 2018; National League for Nursing, 2016). These organizations are invaluable in offering not only guidelines for inclusion of IPE in schools of nursing, but webinars, conferences, and continuing educational opportunities for nurse educators in the realm of IPE and simulation in nursing education (American Association of Colleges of Nursing website, 2018; National League for Nursing, 2016).

Interprofessional Education

While IPE is recognized as being important and recommendations are clear as to expectations for healthcare education delivery, educational institutions overall have sporadically acted upon the recommendations and have continued educating professionals as they have done in the past. Academia has not fully embraced recommendations to include consistent IPE in healthcare curricula. Until recently accreditation agencies in the United States have not been forthcoming with mandated requirements for IPE in educational institutions (Stockert & Ohtake, 2017; Zorek & Raehl, 2013). Without guidelines and expectations by the agencies that provide accreditation for healthcare education, institutions that adopted an IPE component to their curricula in the past were the exception, not the norm (Jeffries, 2012). Nursing graduates are not consistently being prepared to work as part of a team, nor do they have opportunities to learn how to communicate with other disciplines represented on the healthcare team prior to graduation (Zorek & Raehl, 2013). The IOM (2015) reported that a gap still remains related to what employers expect from members of a healthcare team and what is being taught during their education.

Titzer, Swenty, and Hoehn (2012) posited the literature provides little evidence of IPE to enhance communication and teamwork in healthcare workers. In spite of claims that there is a lack of evidence related to IPE contributing to improvement in communication and teamwork by healthcare workers, the body of evidence supporting and recommending the use of IPE continues to grow (Labrague et al., 2018; Liaw, Siau, Zhou, & Lau, 2014; Rossler & Kimble, 2016). A gap is the effects of IPE and interprofessional simulation education (IPSE) on patient outcomes (Lateef, 2010).

The literature offers multiple ways healthcare students could benefit from IPE. First, students can gain knowledge about the role of other disciplines on the healthcare team during the didactic portion of their education (Booth & McMullen-Fix, 2012). Student participation in an IPSE scenario would allow the student to see members of other disciplines functioning in their respective roles. A combination of didactic and simulation experience can lead to a deeper learning of various team members' roles and improved communication and teamwork when caring for actual patients. Secondly, students would learn to collaborate with other disciplines to provide a higher level of care which could ultimately improve patient outcomes (Reising et al., 2011). While the physician functions in a leadership role on the healthcare team, input from other team members improves the decision-making processes that must occur when providing patient care (Schocken, Schwartz, & Stevenson, 2013). Finally, participation in an IP simulation allows students to make mistakes and judgement errors in a safe environment without harming an actual patient (Hood et al., 2014). If necessary, healthcare students can practice multiple times to increase proficiency when working on a healthcare team before actually being part of a team providing care to real patients (Endacott et al., 2014; Ryan et al., 2010).

Research supports the inclusion of IPE in nursing and allied health professional education curricula to improve communication and teamwork skills in hopes of improving patient outcomes (Aebersold & Tschannen, 2013; Titzer et al., 2012). Students have difficulty differentiating between the concepts of communication and teamwork if only taught in a classroom setting (McDermott, Sarasnick, & Timcheck, 2017; Watters et al., 2015). Booth and McMullen-Fix (2012) stated "…high-fidelity simulation …has been shown to be an effective tool for bridging the gap between didactic material and application to the clinical setting" (p. 127).

It is important for multiple disciplines to have opportunities to learn and practice skills together (Wagner, Liston, & Miller, 2011). Simulation can provide a safe environment for healthcare students to learn skills and behaviors such as communication and teamwork (Murphy & Nimmagadda, 2015; Saylor, Vernoony, Selekman, & Cowperthwait, 2016; Wagner et al., 2011). High-fidelity simulation (HFS) is an effective method to teach IP skills and allows students to practice opportunities to hone new skills (Rossler & Kimble, 2016). Communication and teamwork are both essential components of IP care and it is difficult to include one without the other when working in a clinical environment. Teaching both concepts together in the undergraduate environment has the potential to improve the healthcare graduate's ability to be more practice ready after graduation.

Communication

Poor communication among healthcare team members can lead to an increase in patient mortality and healthcare costs, as well as longer hospital stays (Joint Commission, 2014; O'Brien, 2014). Interprofessional education can help prepare undergraduate nursing students to communicate with members of the healthcare team. Jeffries (2012) recognized that communication was an essential skill nursing students need to be practice ready upon graduation. A simulation environment allows students to practice communication with other members of the healthcare team without compromising the health status of a real person (Bambini, Washburn, &

Perkins, 2009; Wang et al., 2015). This ability to communicate effectively with other members of the healthcare team has been identified as being important in the provision of optimal patient care (Stewart, 2018).

Williams and Song (2016) concluded that programs including simulation resulted in improved communication skills. As a “considerable amount of research has now been conducted, it is clear simulation-based training can improve competency and confidence, can yield better communication among team members, and can thereby improve patient safety” (Burrell & Bienstock, 2015, p. 648). Labrague et al. (2018) reported half of the articles they reviewed identified improved IP communication as an important consequence of IP simulation. Communication alone within a discipline is not enough to ensure patients receive safe care. Communication among healthcare disciplines can be a vital factor in whether the team is successful in improving patient outcomes (Kalisch et al., 2009).

Teamwork

Aviation research has shown more than technical skills are needed to ensure safety; the acquisition of skills such as communication and teamwork is vital (Lateef, 2010). Research in healthcare is finding the same results. Effective healthcare teams need to communicate with each other when planning and providing care for patients. Each discipline brings skills and competencies to clinical practice. No single discipline is more important than any other. Healthcare students need to be prepared to collaborate with healthcare professionals from other disciplines after graduation in the clinical environment (Lin et al., 2013; Wilcox, Miller-Cribbs, Kientz, Carlson, & DeShea, 2017). The literature supports undergraduate student exposure to IP situations prior to graduation (Shrader, Dunn, Blake, & Phillips, 2015). Rossler and Kimble

(2016) acknowledged that the increased confidence students may gain from IPE may contribute to improved patient outcomes.

Learning to function as a member of a healthcare team is a skill that must be learned. While educators claim to understand the need for teamwork in the clinical setting, it has not always been a priority in undergraduate curricula (Frankel et al., 2007). As a result, novice nurses are not fully prepared to function competently as a team member in the clinical area (Frankel et al., 2007). When students understand how to work with other disciplines, they are ready to enter the workplace as a member of the healthcare team" (World Health Organization [WHO], 2010).

Simulation

"Simulation is an excellent venue to provide opportunities for interprofessional learners to develop, practice, and refine interprofessional skills such as communication, collaboration, and teamwork within the context of a patient care scenario" (Gordon & Durham, 2014, para. 2). Simulations including IP teams is a good way to improve participant's abilities to communicate with other members on the team (Boet et al., 2013). Failure of the team to work and communicate effectively together has been recognized as resulting in less than optimal patient outcomes (Reed et al., 2017). Using simulation is an innovative teaching/learning pedagogy involving healthcare professional students that need to practice communication and teamwork skills.

Results from research studies over the last 10 years support IPSE to allow students to learn and practice communication skills with other disciplines (Baker et al., 2008; Hood et al., 2014; Papa, n.d.). Simulation in nursing education has been used for decades, however as technology has advanced, HFS offers opportunities for educational programs to implement IPE in a safe realistic environment. Simulation can bridge the gap in IPE by providing that safe realistic environment where it can be taught. Foronda, Liu, and Bauman (2013) concluded there is a significant amount of evidence in the literature to support simulation as an effective educational pedagogy to teach communication and teamwork.

Koo, Idzik, Hammersla, and Widemuth (2013) demonstrated HFS is able to provide participants from multiple disciplines a learning environment in which to develop skills such as communication and teamwork. Shared learning simulations could lead to improved IP communication between members of the healthcare team (Barnsteiner, Disch, Hall, Mayer, & Moore, 2007). The beneficiary of this type of learning is the patient.

The majority of nursing simulation literature reviews attempting to establish a correlation between simulations to patient outcomes in recent years have been focused on nursing education (Aebersold & Tschannen, 2013). Much of the research in the literature centers on an intensive care setting, resuscitation, or crisis management (Liaw, Zhou, Lau, Siau, & Chan, 2014). It becomes apparent that additional research is needed to discover the effect of not only simulation on patient outcomes, but specifically how IP simulation could potentially influence patient outcomes in a medical-surgical clinical area. The use of simulation to prepare healthcare students for what they will face in a variety of clinical areas is a benefit not to be overlooked (Cooper et al., 2010). Interprofessional simulation education can be a powerful learning experience based on the scenario development, student participation, and IP debriefing.

For simulation to be effective in enhancing learning, it needs to be realistic and mimic real-world situations (Bambini, Washburn, & Perkins, 2009). High-fidelity simulations can enhance learning through the realism that can be programmed into the scenarios (King, Conrad, & Ahmed, 2013). Advances in technology have made it possible to design simulation scenarios which allows the participants to practice both technical and non-technical skills without the potential of causing harm to a real patient (Bambini et al., 2009; Jeffries, 2012). The inclusion of simulation in nursing curricula eliminates the dependence on finding clinical patients to assist students to meet course objectives (Messmer, 2008). Simulation offers opportunities for a wide variety of scenarios, including situations that students may not experience with real patients during their educational program.

Failure to Rescue

Herron (2018) recognized communication in crisis situations as a critical skill. Mushta et al. (2017) posited that communication and teamwork are equally important in the failure to rescue process. Once a change in a patient's condition is identified, an escalation of care is needed to prevent a failure to rescue situation (Johnston, Arora, King, Stroman, & Darzi, 2014). Barriers related to failure to rescue include failure to recognize symptoms the patient exhibits and failure to communicate assessment data to an experienced colleague or physician (Johnston et al., 2014). Changes in a patient's condition can be very subtle and without previous experience, novice nurses find it difficult to initiate an escalation of care (Bogossian, Cooper, Cant, Porter, & Forbes, 2015). Assignments of deteriorating patients in the clinical area cannot be controlled and nursing students often have no experience with identification of changes in patient status and the need to escalate care. Herron (2018) stated that "better preparation and continued support of new graduate nurses lead to positive patient outcomes…" (p. e390). Simulation is a way for students to be actively engaged and function in the role of the practicing nurse in challenging situations not always possible in the clinical setting prior to graduation (Jeffries, 2012).

Most new graduates are not prepared to make rapid and informed clinical decisions. Interprofessional simulation scenarios in which students are provided with situations in which a simulated patient's condition deteriorates provides them with opportunities to practice symptom recognition, be involved with other members of the healthcare team, and communicate symptom changes to improve patient outcomes. Interprofessional simulation education has the potential to bridge the gap that remains between nursing education programs and actual clinical practice after graduation (Miles, 2018).

Patient Outcomes

Improved patient outcomes is the goal of healthcare professionals. Well-designed IPE programs should help prepare future professionals to practice in a safe manner which can lead to improved outcomes (Watters et al., 2015). It is difficult and even unethical to conduct studies involving real patients to assess student's clinical abilities and effects on patient outcomes (Galloway, 2009). It is generally believed improved collaboration by IP teams will lead to better patient outcomes (Brock et al., 2013; Rossler & Kimble, 2016). However, there are no definitive studies which provide evidence of communication, teamwork, or simulation improving patient outcomes. Mariani and Doolen (2016) acknowledged a lack of simulation studies which demonstrate "effect of simulation on patient outcomes…" (p. 34). Horsley, O'Rourke, Mariani, Doolen, and Pariseault (2018) reported "…none were noted to study patient outcomes in relation to Sim-IPE" (p. 8).

The evidence in the literature related to effects of communication and teamwork on patient outcomes is inconsistent. Frankel, Gardner, Maynard, & Kelly (2007) contended that "…the relationship between communication and teamwork behaviors and patient outcomes remains unknown" (p. 557). Kalisch, Weaver, and Salas (2009) posited that team training has a positive effect on patient outcomes. Havyer et al. (2016) reported a lack of studies related to teamwork and patient outcomes. Lateef (2010) claimed there had been no evidence that simulation training improves patient outcomes. In spite of the continued growth of simulation in healthcare education, the impact on patient outcomes remains unknown (Aebersold & Tschannen, 2013; Lennox & Anderson, 2012).

Reising et al. (2011) reported data results identifying teamwork as a component of IP practice leading to improved patient outcomes. Labrague, McEnroe-Petitte, Fronda, and Obeidat (2018) identified multiple learning domains including communication and teamwork while performing an integrative review of the literature. These authors concluded that patient outcomes were improved even though not all the agencies had the same competency domains (Labrague et al., 2018). “Interdisciplinary collaboration is identified as a necessity for improving patient outcomes through competency in performance of clinical skills and patient safety initiatives” (Rossler & Kimble, 2016, p. 349).

Messmer (2008) suggested that patient outcomes can be improved by finding ways for healthcare team members to communicate effectively with each other, thereby allowing the best decisions related to patient care. Costello et al. (2018) reported that students participating in their study felt more confident in their abilities to improve patient outcomes when collaborating with others on the healthcare team. Titzer et al. (2012) supported inclusion of IPE in nursing and allied health professional education curricula to improve communication and teamwork skills in hopes of reducing adverse patient events and thereby improving patient outcomes.

Theoretical Framework

The literature related to IPSE identified no specific theoretical framework as a basis for IPSE research studies. Kolb’s Experiential Learning Theory (ELT) was frequently referenced in the literature (Baker et al., 2008; Horsley et al., 2018; Poore et al., 2014; Roessger, 2014; Rossler & Kimble, 2016; Titzer et al., 2012; Turner & Parodi, 2012). Kolb's ELT is one of the most widely known educational theories in higher education (Cherry, 2014; Lisko & O'Dell, 2010). Bandura is most noted for development of the social learning theory. The social learning theory is concerned with observing the learning process among people. These theories address aspects of communication, teamwork, and educational methods.

Experiential Learning Theory

Kolb based his ELT on past research in psychology, philosophy, and physiology (Kolb, 1984). Kolb's ELT is an integrative perspective on learning combining experience, perception, cognition, and behavior (Cherry, 2014). The theory is called experiential for two reasons: 1) to tie the theory clearly to the works of Dewey, Lewin, and Piaget, and 2) to emphasize the role that experience plays in the learning process (Clark, n.d.; Kolb, 1984).The premise of the theory maintains that people learn from their experiences (Kolb, 1984).

Kolb developed the ELT to help explain the connections between human developmental stages of maturation, learning processes, and experiences (Cherry, 2014). He maintained that experiences shape the way learners grasp knowledge, which then influence their cognitive development (Kolb, 1984). In experiential learning, the individual guides the learning process as opposed to the more conventional didactic methods (Lisko & O'Dell, 2010). Kolb described a process of learning from experience that is not something that occurs in a single step (Smith, 2010). Kolb (1984) stated, "Learning is the process whereby knowledge is created through the transformation of experience" (p. 38).

Kolb described four learning modes that shape how learning develops. These four learning modes are: "affective, perceptual, symbolic, and behavioral" (Kolb, 1984, p. 140). In the first stage of the cycle, an individual encounters a new experience that creates an opportunity for learning. According to Kolb's theory, a person cannot learn by simply observing or reading; the individual should actively participate in the experience so they can learn from it (Kolb, 1984). In the second stage, an individual reflects on the experience before making any judgments. Particular attention should be paid to any inconsistencies between experience and understanding (Kolb, 1984). In the third stage, the individual develops ideas to explain their experience. This analysis gives rise to other thoughts or changes a pre-existing concept. In this stage, the individual identifies recurring themes, problems and/or issues that will help with new learning experiences (Kolb, 1984). In the final stage, individuals apply what they learned in the experience to other situations. They use their theories to solve problems, make decisions, and influence people and/or events (Kolb, 1984).

Kolb's ELT has three basic assumptions related to the theory. The first assumption is the point where the learner can enter the learning cycle. Kolb contended learners can enter anywhere in the cycle, but for learning to occur, they must complete the cycle, sometimes more than once (Kolb, 1984). The second assumption is related to change and adaptation. Kolb felt people can change and adapt depending on the learning environment and experience (Kolb, 1984). The third assumption related to the ELT is people are capable of learning different types of skills and bring different experiences with them to the learning environment (Kolb, 1984).

Cherry (2014) found the theory was helpful for learners to explore their strengths during the learning process and use the learning experiences to gain knowledge in areas in which they are weak. Poore, et al. (2014) summarized a learning cycle created by Kolb as follows:

Concrete experience-the learner participates in an experience such as simulation.

Reflective observation-the learner reflects on the experience. Abstract conceptualization-the learner considers thoughts and reflections to identify the significance of the learning experience and considers what may have been done differently to enhance the outcome. Active experimentation-involves using what was learned to direct future practice (p. e244).

Adaptation during the simulation can be observed by the facilitator as the participants interact with each other and decisions are made about the simulated situation. Socio-emotional development should occur as the participants work together and learn from, with, and about each other in the simulation environment.

Poore, et al. (2014) explored Kolb's ELT as a framework for IPSE to "improve communication and collaboration among health professional students" (p. e242). These authors concluded Kolb's ELT could be useful for designing, development, and implementation of IPSE experiences (Poore et al., 2014). Experiential learning has been effective in a variety of team learning experiences (Baker et al., 2008). McLeod (2010) advocated for Kolb's learning stages to be used to develop appropriate learning opportunities for students.

Social Learning Theory

Bandura's social learning theory explains how people learn new things and develop new behaviors by observing other people. The premise of the theory is that observing others will lead to learning a particular behavior (Bandura, 1986; Cherry, 2017). "By observing others, one forms rules of behavior, and on future occasions this coded information serves as a guide for action" (Bandura, 1986, p. 47). Bandura posited that a change of behavior is not guaranteed just by observing others (Sincero, 2011). Bandura identified three models of observational learning, which include: a) a real person performing the behavior to be learned, b) a verbal instruction providing details and descriptions of the behavior, and c) a symbolic model, which is a real or fictional character demonstrating the behavior via some kind of media sources (Sincero, 2011).

Bandura determined after developing the modeling process of the social learning theory that not all observed behaviors are learned, nor does learning necessarily result in behavioral changes. The modeling process includes the following steps: a) attention, b) retention, c) reproduction, and d) motivation (McLeod, 2016). In the attention step, the social cognitive theory implies that the learner must pay attention to a particular behavior in order to learn it (McLeod, 2016). In order to learn from the behavior of the model (the person that demonstrates the behavior), anything that distracts the learner should be removed from the learning environment. Step two involves retention of the new behavior. If the learner does not retain the behavior, deep learning does not occur (Cherry, 2017). Without retention of the behavior, the learner may have to observe the modeled behavior multiple times. The third step, reproduction, requires the learner to demonstrate the newly learned behavior. Repeated practice at this step is important for improvement in the learner's ability to replicate the learned behavior (Cherry, 2017). Motivation, the last step in the modeling process requires the learner to be motivated to continue to repeat the behavior (McLeod, 2016). Positive reinforcement encourages the learner to want to demonstrate not only that they have learned the new behavior, but that they are proficient at performing it (Cherry, 2017).

While the initial study which led to the development of Bandura's social learning theory was based on negative behavior observed by children, learning by observation can be used to teach positive behaviors. The social learning theory can be used for planning and designing a simulation. According to Kaakinen and Arwood (2009) "the simulation would provide planned stimuli organized in a way so as to give the participant the opportunity to respond" (para. 16).

Conclusion

The number of studies exploring IPE, including the additional component of simulation, has grown significantly over the last decade. The evidence supports and recommends IPE with the inclusion of clinical simulation. Healthcare continues to change and provision of care needs to keep pace with those changes. One change that should be expected to occur is IP communication and teamwork in the clinical setting and at the patient's bedside. Employers expect graduate nurses to be a functioning member of the healthcare team and communicate effectively with other members of the team. The literature continues to show lack of consistent IPE in professional healthcare education. Healthcare students have a lack of substantive exposure to other disciplines. This practice continues to produce healthcare professionals unprepared to function in the role they are expected to assume upon graduation.

The gap that continues in the science is how IPE affects failure to rescue and patient outcomes. It is difficult to measure patient outcomes in the clinical area. Designing studies to explore IPE effects in the practice setting could be seen as unethical if interventions were denied to real patients. Simulation can help bridge that gap. Simulation scenarios can be developed including IP components and challenging scenarios. Simulated patient outcomes can be measured, analyzed, and conclusions made as to effects on patient outcomes that could possibly be generalized to real patient situations. The proposed study will attempt to address the gap in the science by analyzing data to assess effects of interprofessional care and time to rescue on patient outcomes following the IP intervention.

Kolb's ELT and Bandura's social learning theory will provide the framework for the proposed simulation study. These theories complement each other by their premises of learning by experience and observation. In this way, they fit the designing, planning, and implementation of a simulation study. Learning by observation aligns with the IP aspect of the study. In addition, learning by experience aligns with practice in an IP setting. Communication will occur during the IP experience, which is another learning aspect included in the IP simulation environment. Both theories could address the communication component of the study.

Chapter 3

Methodology

Research Design

A randomized controlled trial pilot study at a single site involving undergraduate nursing students was conducted. The purpose of the study was two-fold. First, to explore nursing student perceptions of whether interprofessional (IP) communication and teamwork has any effect on time to rescue a simulated patient with a deteriorating respiratory status. Secondly, to explore whether IP communication and teamwork reduces time to rescue a simulated patient with a deteriorating respiratory status, thus improving the simulated patient outcome. The intent of the study was to address gaps in the science of nursing related to IP communication and teamwork, time to rescue, and potential effects on patient outcomes. The research questions were: 1) *how do nursing students perceive IP communication and teamwork effects on the time to rescue a deteriorating simulated patient?* and 2) *what effect does IP communication and teamwork have on time to rescue a deteriorating simulated patient?*

Prior to seeking Institutional Review Board (IRB) approval, permission to conduct the study was obtained from the President of the College (Appendix A). Once permission was granted and the proposal approved, the study proposal was submitted to the University of Missouri-Kansas City (UMKC) School of Nursing and Health Studies IRB for approval to conduct the research. Following IRB approval by the UMKC School of Nursing and Health Studies, a copy of the approval was provided to the Chair of the College of Nursing and Health Sciences IRB where the study took place.

All research study activities occurred during a one week time period. The simulation scenario was repeated as often as necessary until all students had experienced the simulation scenario. Each simulation session was estimated to encompass 20-25 minutes of time. A 30-minute debriefing session followed completion of each simulation.

Sample

According to Polit and Beck (2012) “Most nursing studies cannot expect effect sizes in excess of .50; those in the .20 to .40 range are most common” (p. 424). A power analysis using an effect size of 0.4, an alpha level of 0.05, and a power of 0.9 yielded a sample size of 108 participants for the proposed study (Faul, Erdfelder, Lang, & Buchner, 2007). A convenience sample was used to recruit eligible participants enrolled in a junior level nursing clinical course. All students enrolled in this course were offered the opportunity to participate in the simulation research study. This course includes baccalaureate and associate degree nursing students. Since the proposed simulation research scenario is part of the clinical nursing course, all students will participate in the simulation experience even if they choose not to be a participant in the research study. Inclusion criteria for the study are: 1) enrolled in the junior level nursing clinical course, 2) over 18 years of age, and 3) previous simulation experience. Students will be excluded from the study if they are absent from clinical on the day of the study or if they choose not to be a study participant.

Students had content lectures prior to the simulation study related to chronic obstructive pulmonary disease (COPD) and anxiety in junior level clinical nursing courses. Content presented during lecture included care of and common treatment modalities for a COPD patient who experiences a deterioration of respiratory status and anxiety related to breathlessness. The participants had education and practice related to their role as a student nurse during previous simulations and clinical experiences with actual patients. Participants previously completed a health assessment course during which they learned how to perform a respiratory assessment that will be required during the simulation.

Setting

The College provides baccalaureate nursing education to local, national, and international students. Second year associate degree nursing students are enrolled in junior level courses at the College through a consortium with a local community college. There are over 250 baccalaureate nursing students and 25 associate degree nursing students enrolled at the college each academic year. The proposed study was conducted in the simulation center of the College of Nursing and Health Sciences.

The College has a state-of-the-art simulation facility. The simulation center is equipped with sophisticated, computer-driven, high-fidelity manikins which can exhibit the manifestations of an acute exacerbation of COPD. A classroom is available on-site at the simulation center for participants to meet and receive information about the study from the primary investigator, to complete the consent form, to wait for their turn in the simulation session, and complete the Demographic survey/Self-Assessment Teamwork Tool (SATT) (Appendix B) as part of the debriefing sessions.

Operation of the computer software for the manikins was conducted in a centralized location resembling a nurse's station located outside the actual simulation rooms. Two simulation rooms, each containing a high-fidelity manikin, were used each day the simulation study was being conducted. One room was designated the control group room and the other was the intervention group room. Both simulation rooms were furnished with equipment which would be found in a clinical patient room in a hospital setting needed to provide care for the simulated patient (e.g., sink, gloves, handwashing gel, stethoscope, call light, intravenous pump/pole/fluids, oxygen tubing, and patient's chart). A touch-screen monitor was used to display vital signs and oxygen saturation rates. The participants had the option to obtain additional vital signs and oxygen saturation rates at any time during the simulation using the touch-screen monitor.

Roles

Two simulation nursing faculty members, a clinical nursing faculty member, a Respiratory Therapist (RT) from the college's Health Sciences department, and a research assistant received orientation to the simulation by the primary investigator prior to the study. This orientation took approximately an hour each. Faculty orientation included simulation scenario specifications, role expectations, and forms that would be used during the simulation.

Simulation Nursing Faculty

The simulation nursing faculty members were provided with oral and written information about initial simulation scenario information (vital signs-pulse 88, respiratory rate 28, blood pressure 130/70, oxygen saturation rate of 92% with oxygen at 2/liters a minute, and lung sounds with minimal crackles) that will need to be pre-programmed into the computer program prior to the beginning of each simulation session. The pre-programmed scenario information was the same for both the control and intervention groups. Two simulation nursing faculty members were assigned to operate the computer equipment for the control group for the intervention group for all simulation sessions throughout the week. The simulation nursing faculty members alternated between the control room and the intervention room each time the simulation was performed. This provided a degree of randomization of the simulation nursing faculty members. The simulation nursing faculty members had access to a Simulation Timeline for the simulation scenario (Appendix C). The written timeline included the standard interventions the participants may implement and the expected manikin responses the nursing simulation faculty members would need to manually make using the computer software.

Respiratory Therapist (RT)

The RT is employed as a faculty member at the college and teaches in the Associate Degree respiratory therapy program. The RT received orientation on communication and teamwork techniques to use as a guideline during the simulation intervention scenario, the RT role in the simulation (Appendix D), and the time frame involved. The RT functioned in the RT role only with the intervention group during the simulation scenario. The RT did not know which nursing students were scheduled to be at the simulation center as part of their clinical nursing course experience or as potential participants in the study prior to seeing them on the simulation day. The RT access to nursing students was minimal prior to the study.

Senior Level Nursing Student Volunteer

A senior level nursing student volunteer functioned as an extra pair of hands for the control group only during the simulation scenario. The senior level nursing student volunteer was advised of how much assistance could be provided to the participants in the control group (Appendix E). The senior level nursing student volunteer did not make specific recommendations as to what interventions the control group participants should implement at any given time during the simulation. The senior level nursing student volunteer informed the control group after randomization and prior to the beginning of the simulation sessions about their role as ‘extra hands’ during their simulation sessions.

Research Assistant

The research assistant completed the Protection of Human Subjects course offered by the UMKC prior to participation in the study. The research assistant was responsible for randomizing students into control and intervention groups, obtaining signed consent forms, and making participant assignments in each group. The research assistant entered the students by number only obtained from the consent forms on the Time to Rescue Monitoring Log sheet (Appendix F) which was provided to the simulation nursing faculty and the clinical nursing faculty before the simulations began for the day. Students who declined to be a participant in the study were removed from the Time to Rescue Monitoring Log sheet by the research assistant after the simulation was completed and before the Time to Rescue Monitoring Log sheet was given to the primary investigator.

Procedures

Programming the Manikins

The pre-programmed simulated patient assessment data mimicked what could be observed in a real patient in the clinical area experiencing a chronic respiratory disease. The participants had the ability to talk to the simulated patient and receive subjective data related to their respiratory status. The participants were able to assess vital signs, lung sounds, and oxygen saturation of the simulated patient as part of their physical assessment. The participants were able to perform an on-going assessment of patient status following a decline in respiratory status with accompanying anxiety and implementation of standard interventions. The simulation nursing faculty members made manual changes to the simulated patient in response to interventions by the participants during the simulation. If study participants in either the control group or the intervention group omitted expected standard interventions during the simulation scenario, the simulated patient’s respiratory and anxiety status would not improve.

Pre-Simulation

All students arrived at the simulation center each day at the time designated by the clinical nursing faculty and met in the simulation center classroom. Initial contact was made by the primary investigator when the students were assembled in preparation for the simulation to begin. The primary investigator explained the study to the all the students and informed them that participation was voluntary and confidential. The primary investigator left the room after providing the students with an overview of the study.

The primary investigator provided the research assistant with packets marked with either an 'A' (for the control group) or 'B' (for the intervention group). Each packet contained the study paperwork (communication and teamwork information-intervention group only, consent form, Demographic survey/SATT form, and a short crossword puzzle for non-participants to complete instead of the post-simulation forms). All papers in the packet were marked with the corresponding letter on the packet. Participants were randomized by the research assistant to either the control or intervention group by having them draw a folded slip of paper from a jar. The slips of paper were marked with an 'A' for the control group and 'B' for the intervention group. Random assignment to groups eliminates systematic bias in the groups which could affect study outcomes (Polit & Beck, 2012). The research assistant distributed the packets marked with an 'A' to those participants who drew a slip of paper marked with an 'A' and packets marked with a 'B' to those who drew a slip of paper marked with a 'B'.

All students completed the consent form (Appendix G). Students indicated their decision to be a study participant by signing the form. All students used the last four-digits of their cell phone number as a numerical identifier on the consent form and wrote it on the envelope label and the label on each paper included in the envelope. The birth month and year was included on the consent form to differentiate participants having the same four digit cell phone numerical identifiers. Consent forms were given to the research assistant. The research assistant assigned two participants from the control group together and two participants from the intervention group together under the ‘Student Participants by Number’ on the Time to Rescue Monitoring Log sheet. Participants in the intervention group reviewed a brief educational sheet related to interprofessional communication and teamwork included in their packet (Appendix H) prior to the start of the simulation.

Simulation Scenario

After randomization to groups, completion of the consent form, and assignment by the research assistant, the first two students from the control group and the first two students from the intervention group (identified by the four-digit numerical identifier on the Time to Rescue Monitoring Log sheet) proceeded to their respective simulation rooms. The simulation nursing faculty gave the students in each group a verbal report about their simulated patient (Appendix I). After report was completed, the simulation began as the students started to perform a respiratory assessment on the simulated patient. The Simulation Timeline was followed as the students began to perform the respiratory assessment. Two minutes after initiation of the assessment the simulated patient experienced a change in condition. The simulation nursing faculty noted the time on the Time to Rescue Monitoring Log as they manually made changes to vital signs, reduced the simulated patient’s oxygen saturation to 88%, added more crackles in the lungs, and the patient became anxious related to breathlessness. A normal oxygen saturation is 95-100% and is measured using a pulse oximeter. A decline in oxygen saturation is often the earliest indicator of a change in respiratory status requiring intervention to prevent patient deterioration (Fournier, 2014). Oxygen saturation rates below 90% require intervention ("Pulse Oximetry," 2011).

Participants in both groups had 15 minutes to implement standard interventions for a decline in respiratory status of a COPD patient. The clinical nursing faculty was available as a resource for the control group. The RT arrived to the intervention room two and one-half minutes after the participants begin their respiratory assessment to perform a morning respiratory assessment as would be assigned to a RT.

The students were expected to begin implementing standard interventions to rescue the simulated patient. Standard interventions included: raising the head of the bed, increasing the oxygen flow rate, pursed lip breathing, monitoring vital signs, notification of the physician (to report a change in condition, request an as needed nebulizer treatment and obtain an intravenous route for the anti-anxiety medication), and administration of anti-anxiety medication or other medications as ordered. The simulation nursing faculty made changes in vital signs, oxygen saturation rate, and anxiety level at two minute intervals after the initial change in the simulated patient’s condition. If all the standard interventions were implemented in either the control group or the intervention group by 15 minutes following the decline in respiratory status, the oxygen saturation improved to 90% and the simulation ended. Oxygen saturation rates of 90% and above indicate a stabilization of the patient’s respiratory status and is a positive outcome for the patient. The standard interventions implemented during the simulation scenario should have a direct effect on the time to rescue the deteriorating simulated patient. If all the standard interventions were not implemented by the participants in either the control group or the intervention group by 15 minutes following the decline in respiratory status, the simulated patient experienced a respiratory arrest, and the simulation ended. Participants in either group (control or intervention), had the potential to implement the standard interventions faster or slower than expected, thus having a random impact on the time to rescue.

When the simulation ended, the time was noted on the Time to Rescue Monitoring Log by the simulation nursing faculty. The simulation nursing faculty indicated on the Time to Rescue Monitoring log the outcome of the simulated patient (oxygen saturation rate of 90% or respiratory arrest). Once the simulations and the Time to Rescue Monitoring Logs were completed for the day, the research assistant obliterated the recordings for any non-participants with a black marker. This ensured that non-participant data was not included in the data analysis after the study was complete.

Debriefing

Participants returned to the simulation classroom when their simulation was finished to await completion of the simulation by all members of the clinical group for the day. They were cautioned to not discuss the simulation with participants who had not completed the simulation. The 30-minute debriefing facilitated by the simulation nursing faculty members and the clinical nursing faculty member followed completion of all simulations each day. All students, the RT, the clinical nursing faculty member, and the simulation nursing faculty members attended the debriefing session together. All participants that agreed to be included in the study completed a Demographic form/SATT survey located in their packet after the simulation sessions were completed for the day and prior to beginning the debriefing session. Demographic information included: age, gender, race, baccalaureate or associate degree student, and history of IP simulation experience. Completion of these surveys took approximately five minutes to complete. Non-participants had a short crossword puzzle to complete to maintain their anonymity. Students were asked to place the Demographic form/SATT survey/crossword puzzles in the packet, seal the envelope, and give the envelope to the research assistant.

Student performances during the simulation scenario and the outcomes of the scenarios were discussed in the group debriefing session. Debriefing was facilitated by the simulation nursing faculty members and the clinical nursing faculty member and allowed each participant to share their own thoughts and experiences that occurred during the simulation. The simulation nursing faculty and the clinical nursing faculty had debriefing questions to include during the debriefing session (See Appendix J). These questions were in addition to the questions the simulation nursing faculty or clinical nursing faculty might ask to guide the debriefing discussion. Each student had the opportunity to hear the thoughts and experiences of the simulation by their peers.

No hazards to students were anticipated during the simulation intervention; however students were given the option of evaluating their individual performance and the simulation outcome with the simulation nursing faculty members or the clinical nursing faculty member following the group debriefing session. In addition, the college social worker was available to counsel students who wanted to discuss the simulation outcome further after the debriefing. The social worker would be able to make the determination to refer individual students for additional free counseling services available to anyone associated with the college if deemed necessary.

When all simulation scenarios were completed for the day, the research assistant removed the non-participant data from the Time to Rescue Monitoring Log. The sealed envelopes and the Time to Rescue Monitoring Log were taken to the main College campus and given to the primary investigator by the research assistant. The consent forms, Demographic/SATT surveys, and Time to Rescue Monitoring Logs have been kept in a locked drawer in the primary investigator's locked office.

Self-Assessment Teamwork Tool

The Self-Assessment Teamwork Tool (SATT) was used as a post-simulation survey to measure nursing student's perception of communication and teamwork during the simulation. All participants completed the tool after the simulation and prior to the debriefing session. Permission to use the tool was obtained from the designated author of the tool (See Appendix K). A benefit of the tool is that it allows students to self-report their perceptions of teamwork behaviors during a simulation. Two factors on the tool: information sharing/support and teamwork coordination/communication align with the research questions for the study.

The SATT was shown to be a reliable and valid tool to assess inexperienced healthcare students (Roper, Shulruf, Jones, Currie, & Gordon, 2018). A Chronbach alpha of greater than 0.70 was used to determine reliability and internal consistency (Roper et al., 2018). During validation of the two-factor loadings of information sharing/support and teamwork coordination/communication, "Chronbach alphas were 0.84 and 0.75 for the two factors, respectively" (Roper et al., 2018, p. 2).

Plans for Data Analysis

The Time to Rescue Monitoring Log was given to the primary investigator in a sealed envelope at the end of each day by the research assistant. Confidentiality was maintained by keeping all participant forms and the Time to Rescue Monitoring Log forms in a locked cabinet in the primary investigator's locked office. Password protected computer equipment has been used to store and analyze data. Only the primary investigator has access to the

Demographic/SATT survey and the Time to Rescue Monitoring Log forms once received from the research assistant.

Simulated patient oxygen saturation status and the length of time to rescue were analyzed after the simulation scenario using the times recorded and the simulated patient outcome on the Time to Rescue Monitoring Log. A computer program for data analysis was available for the primary investigator's use to complete data analysis following completion of the simulation study. Data from the Demographic/SATT survey and the Time to Rescue Monitoring Logs were entered into the Statistical Package for the Social Sciences (SPSS) Version 25 by the primary investigator.

Statistical Analysis

Descriptive statistics was used to analyze the demographic data. Descriptive statistics help describe and understand the features of a specific data set by giving short summaries about the sample and measures of the data (Kellar & Kelvin, 2013). The most recognized types of descriptive statistics are the mean, median, and mode. All descriptive statistics are either measures of central tendency or measures of variability (Kellar & Kelvin, 2013). These two measures use graphs, tables, and general summaries to promote understanding of the meaning of the analyzed data.

An independent *t*-test was used to analyze the study data obtained to answer the research questions. The independent *t*-test is an inferential statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups (Kellar & Kelvin, 2013). The independent *t*-test can be used to analyze a control and experimental group ("Statistics," 2018). An independent *t*-test compares whether two groups have different average values. The *t*-test is described as a robust test with respect to the assumption of normality (Kellar & Kelvin, 2013).

The independent *t*-test requires that the dependent variable is approximately normally distributed within each group. The independent *t*-test assumes the variances of the two groups being measured are equal in the population. When reporting the result of an independent *t*-test, included would be the *t*-statistic value, the degrees of freedom (df) and the significance value of the test (*p*-value) (Kellar & Kelvin, 2013). In order for the researcher to provide enough information to fully explain the results of an independent *t*-test, the result of normality tests, Levene's Equality of Variances test, the two group means and standard deviations, the actual *t*-test result and the direction of the difference (if any) should be included ("Statistics," 2018).

Conclusion

While many studies have explored interprofessional simulation education (IPSE), this will be the first study to use an IP simulation scenario including a communication and teamwork intervention to attempt to determine the effect it has on simulated patient outcomes, specifically time to rescue and improved oxygen saturation status. This study had the potential to show patient outcomes can be positively affected if there is therapeutic communication between disciplines. The parts of the study which make it unique in the simulation community and IPSE are:

- Randomized controlled trial
- IP simulation intervention study
- Explores IP interventions effect on time to rescue and simulated patient outcomes
- Explores nursing student perceptions of communication and teamwork on time to rescue a simulated patient

It was hypothesized that therapeutic communication between disciplines should have positive effects on patient outcomes. The ability to test this hypothesis on real patients is problematic. It would be unethical to use non-therapeutic communication techniques during the care of a real patient. However, a simulation scenario provides a safe environment where negative events can be conducted without harm to a real person. Healthcare professionals need to be aware of the potential positive impact IP communication and teamwork can have on patient outcomes. Interprofessional team members have the ability to take communication and teamwork skills learned and practiced in a simulated setting into the clinical setting and make positive changes to real patient outcomes.

CHAPTER 4

RESULTS

The purpose of the randomized controlled trial pilot study was to explore nursing student perceptions of whether interprofessional (IP) communication and teamwork had any effect on time to rescue a simulated patient with a deteriorating respiratory status. In addition, the study sought to explore whether IP communication and teamwork reduced time to rescue a simulated patient with a deteriorating respiratory status. If students perceived IP communication and teamwork affected the time to rescue a deteriorating patient status and IP communication and teamwork reduced the time to rescue a patient with a deteriorating status, the results could support improved simulated patient outcomes. The research questions for the study were: *'how do nursing students perceive IP communication and teamwork effects on the time to rescue a deteriorating simulated patient?'* and *'what effect does IP communication and teamwork have on time to rescue a deteriorating simulated patient?'*

The study was designed to have a simulated patient with a diagnosis of chronic obstructive pulmonary disease (COPD) experience a deterioration in respiratory condition. After receiving Institutional Review Board (IRB) approval from the University of Missouri-Kansas City (UMKC) (Appendix L), the proposed research study was conducted over a three day period of time. Two simulation rooms, each containing a high-fidelity manikin, were used each day the simulation study was conducted. One room was designated the control group room and the other was the intervention group room.

Participants in the control and intervention groups all received the same background information about the simulated patient from the simulation nursing faculty members prior to performing a respiratory assessment. This sharing of information was similar to the report which would be received in an actual patient clinical area. The inclusion of a respiratory therapist to provide rescue interventions with the experimental groups added the interprofessional component to the study. The role of the respiratory therapist was to collaborate with the nursing student participants in the intervention group to rescue the simulated patient. Participants had 15 minutes from the time the simulated patient's condition began to deteriorate (oxygen saturation rate dropped below 90%) to implement standard interventions intended to rescue the simulated patient. Improvement would be determined by a return of the simulated patient's oxygen saturation rate to 90% or above.

Sample

A convenience sample was used to recruit eligible participants enrolled in a junior level nursing clinical course. This course included baccalaureate and associate degree seeking nursing students. All students enrolled in the course were offered the opportunity to participate in the simulation research study. All students participated in the simulation experience even if they chose not to be a participant in the research study. A research assistant was responsible for randomizing students into control and intervention groups, obtaining signed consent forms, and making participant assignments in each group. Forty-one students were consented by the research assistant. One hundred percent of the eligible students (N=41) consented to participate in the research study. Twenty participants (n=20) were randomized into the control group. Twenty-one participants (n=21) were randomized into the intervention group.

Setting

The study was conducted in the simulation center of the College of Nursing and Health Sciences. The College has a state-of-the-art simulation facility. The simulation center has sophisticated, computer-driven, high-fidelity manikins which were programmed to exhibit the manifestations of a patient experiencing an acute exacerbation of COPD. A classroom was available at the simulation center where the participants met and received information about the study from the primary investigator. Participants completed the consent form and were randomized into control or intervention groups by the research assistant, The Demographic survey/Self-Assessment Teamwork Tool (SATT) (Appendix B) was completed as part of the debriefing sessions.

A centralized area resembling a nurse's station located outside the actual simulation rooms allowed the simulation nursing faculty to operate the computer software for the manikins during the simulation study. A touch-screen monitor was used to display vital signs and oxygen saturation rates in each of the simulation rooms. The participants had the option to obtain additional vital signs and oxygen saturation rates at any time during the simulation using the touch-screen monitor. The participants in the intervention room were assisted by a respiratory therapist to manage the deteriorating patient. A senior level student volunteer was available in a supportive (non-hands on) position to the participants in the control room.

Results

Data from the Demographic survey, the Self-Assessment Teamwork Tool (SATT), and the Time to Rescue Monitoring Logs were entered into the Statistical Package for the Social Sciences (SPSS) Version 25 by the primary investigator. Descriptive statistics were used to analyze the demographics. Independent *t*-tests were used for the data analysis from the Time to Rescue Monitoring Logs and the SATT tool.

Demographics

The primary investigator provided the research assistant with packets marked with either an 'A' (for the control group) or 'B' (for the intervention group). Each packet contained the study paperwork. Participants were randomized by the research assistant to either the control or intervention group by having them draw a folded slip of paper from a jar. The slips of paper were marked with an ‘A’ for the control group and ‘B’ for the intervention group. The research assistant distributed the packets marked with an ‘A’ to those participants who drew a slip of paper marked with an ‘A’ and packets marked with a ‘B’ to those who drew a slip of paper marked with a ‘B’.

Twenty participants (n=20) were randomized into the control group and 21 (n=21) participants were randomized into the intervention group. The study participants consisted of 68.3% (n=28) females, and 63% (n=26) were between the ages of 18-24 year old. The participants were 97.6% (n=40) Caucasian. The education level of the participants was 68% (n=28) baccalaureate degree seeking and 29% (n=12) associate degree seeking students. Thirty-eight of the participants (92.7%) acknowledged previous interprofessional education experience.

Time to Rescue Monitoring Logs

An independent *t*-test was conducted to compare the time to rescue between the control group A and the intervention group B. A 95% confidence interval and .05 significance level were used for the *t*-test analysis. Levene’s test for equality of variances was performed. Levene’s test determines if the two conditions have almost the same or different amounts of variability between scores (Polit & Beck, 2012). A *p*-value greater than .05 means that the variability in the control group scores do not vary much more than the intervention group, or that the variability between the two groups is not significantly different (Polit & Beck, 2012).

There was statistical significance of interprofessional communication and teamwork improving time to rescue a deteriorating patient between the control group A (M=10.6, SD=2.722) and the intervention group B (M=9.24, SD=1.480); $t(39)=2.003$, $p=.05$. These results indicate that it is possible for interprofessional communication and teamwork to affect time to rescue a patient with a deteriorating condition. Table 1 shows a comparison of the minimum and maximum time in minutes to rescue between the control group A and intervention group B.

Table 1. Minimum-Maximum Minutes to Rescue by Group.

	Control Group	**Intervention Group**
Minimum Time to Rescue (Minutes)	6	7
Maximum Time to Rescue (Minutes)	15	12
Range (Minutes)	9	5

Self-Assessment Teamwork Tool

An independent *t*-test was conducted to examine self-assessment of communication and teamwork of the participants using the SATT which was completed post-simulation. A 95% confidence interval and .05 significance level were used for the *t*-test analysis. Levene's test for equality of variances was performed.

The results of the independent *t*-test did not show statistical significance for the total score of the SATT (M=61.05, SD=8.45); $t(39)=-1.866$, $p=.07$). The control group A had a (M=58.60, SD=9.304) and the intervention group B had a (M=63.38, SD=6.989). These results indicate there is no overall difference in perception that interprofessional communication and teamwork had an effect on time to rescue.

Three of the individual items on the SATT did show statistical significance (*Task implementation was well coordinated* had a significance of $p = .03$, *When expressions of concern were raised and not responded to appropriately, team members took action* had a significance of $p = .05$, and *Questions were responded to appropriately* had a significance of $p = .02$) using the independent *t*-test for analysis. Based on the statistical significance of the participant's self-assessment of the three items from the SATT, the student perception was that these aspects of IP communication and teamwork would have an effect on time to rescue.

Conclusion

This small randomized controlled trial pilot study was the first of its kind attempting to explore nursing student's perceptions of IP communication and teamwork on time to rescue a deteriorating simulated patient status, IP communication and teamwork's influence on reduction of the time to rescue a deteriorating patient, and resulting effects on patient outcomes. Results from the Time to Rescue Monitoring Log did have statistical significance of IP reducing the time to rescue, indicating that the IP intervention had an effect on time to rescue and patient outcomes.

The overall results of the SATT were not statistically significant to show that nursing students' perceived IP communication and teamwork had an effect on time to rescue a deteriorating patient. Three of the individual SATT items did have statistical significance. These statistically significant results indicate nursing students found those specific communication and teamwork items could influence time to rescue a deteriorating patient.

Additional studies with larger sample sizes could further explore IP communication and teamwork on time to rescue deteriorating patient conditions. Simulation settings allow exploration of complicated patient issues without harming real patients. Technology has provided ways to simulate actual patient conditions and responses to participant interventions, thus allowing practical learning in a safe environment. The inclusion of an IP component into a simulation setting mimics what nursing students can expect to observe when in the clinical area. The ability to practice complicated situations with other disciplines offers the opportunity to have a positive effect on time to rescue in a real clinical setting and potentially improve patient outcomes.

CHAPTER 5

DISCUSSION

The data obtained from this study provides an initial look at nursing student perceptions of interprofessional (IP) communication and teamwork on time to rescue a patient experiencing a deteriorating respiratory condition. The inclusion of interprofessional education (IPE) in nursing academia aligns with the Institute of Medicine's (IOM) recommendations dating back 50 years (IOM, 1972). A review of the literature alludes to the need for and potential benefits of interprofessional education (IPE) for nursing students, but lacked definitive evidence to support the claims (Liaw et al., 2014; Mariani & Doolen, 2016; Poore et al., 2014; Titzer et al., 2012).

Research Question One Conclusion

The first research question was '*how do nursing students perceive IP communication and teamwork effects on the time to rescue a deteriorating simulated patient?*' The intervention group read material included in the packet provided by the research assistant related to IP communication and teamwork prior to the start of the study. The intervention group had the respiratory therapist as part of their team to manage the deteriorating patient's care.

All study participants completed the Self-Assessment Teamwork Tool (SATT) post-simulation. The tool contains 10 items related to participant perceptions of IP communication and teamwork. Analysis of the statistics for the total number of participants did not reach statistical significance using a .05 significance level. However, analysis of the control group and the intervention group separately showed the intervention group had higher SATT scores than the control group. This would indicate that the participants in the intervention group had a perception that IP communication and teamwork did have an effect on time to rescue.

Three of the individual items on the SATT had statistically significant results using a .05 significance level. Item four: *Task implementation was well coordinated* (p = .03), Item five: *When expressions of concern were raised and not responded to appropriately, team members took action* (p = .05), and Item six: *Questions were responded to appropriately* (p = .02) had the lowest p-values of the 10 items on the SATT. These results indicate participants' perceived some components of IP communication and teamwork had an effect on task implementation, taking action when appropriate, and questions were answered. The results of these three items on the SATT suggest that participants saw them as having a positive effect of IP communication and teamwork on time to rescue.

Research Question Two Conclusion

The second research questions was '*what effect does IP communication and teamwork have on time to rescue a deteriorating simulated patient?*' Statistical analysis of the data from the Time to Rescue Monitoring Logs showed the overall time to rescue was statistically significant (p = .05) using a .05 significance level. Analysis of the control group and the intervention groups separately showed the intervention group had a lower time to rescue compared to the control groups (Table 1, Chapter 4). These data results indicate that IP communication and teamwork have a positive effect on time to rescue a deteriorating patient.

When analyzing the results of both the SATT and the Time to Rescue Monitoring Logs together results indicate the intervention group that had IP assistance to manage care for the deteriorating patient, had a shorter range in minutes of time to rescue than the control group. The intervention group also had higher scores on the SATT than the control group. The conclusion from the individual group data is there is a correlation between participant perception of IP communication and teamwork on time to rescue and the actual time to rescue the deteriorating patient in the intervention groups.

Limitations

The study did have some limitations. The first limitation was the small sample size. A power analysis yielded a sample size of 108 participants for the study. The available sample size was 41 students. The enrollment in the junior level clinical course is relatively stable from semester to semester. Achieving a sample size of 108 participants in a single semester would not be possible. Second, the study was scheduled close to another simulation that used several of the same interventions (raise the head of the bed, apply oxygen, call a Rapid Response). This could have had an effect on participant performance and the time to rescue in both groups. A third limitation involved scheduling of the study. The study was scheduled in a short time period from when the participants had lecture on the disease processes used in the study (Chronic Obstructive Pulmonary Disease and anxiety). The participants could have recalled the recent lecture information quicker than if more time had elapsed between lecture and participation in the study. And finally, there was a lack of focus on the mental health of the simulated patient during the deterioration of respiratory status.

Contribution to the Science of Nursing

The Institute of Medicine (IOM), nursing researchers, and nursing educators have made repeated recommendations that healthcare education should move out of silos and become more interprofessional (American Association of Colleges of Nursing, 2014; IOM, 2015; Labrague et al., 2018; Titzer et al., 2012). Interprofessional healthcare education has not reached its full potential and gaps are still found in the academic environment (American Association of Colleges of Nursing, 2014; IOM, 2015; Labrague et al., 2018; Titzer et al., 2012). The data from this study is the first to explore IP communication and teamwork on time to rescue and nursing student perceptions of the impact this can have on patient outcomes. The simulation environment allows nursing students to practice IP skills safely, observe the role of other disciplines, and become better prepared to be a team leader/member in the clinical setting after graduation. Future studies addressing some of the limitations of the study may provide different results.

Patients, students, and employers can all benefit from the results of this study and future studies exploring time to rescue and patient outcomes. Patients will benefit from the additional knowledge and expertise of the nurses providing their care. Students will gain confidence from the knowledge and experience from involvement in simulated scenarios allowing them opportunities to practice IP communication and teamwork. Students will be able to see the correlation between working with another discipline and the effect on patient outcomes by a reduction in time to rescue. Employers will benefit by having staff better prepared to identify a deteriorating patient condition and implementing interventions to rescue the patient in a timely manner.

Future Studies

Since this was a pilot study, future studies should be conducted to explore the multiple concepts inherent in the study: nursing student perceptions, IP education, IP communication and teamwork, time to rescue, and patient outcomes. Pulling all these concepts together can be challenging, but well worth the effort if patient outcomes improve. Future research can use the evidence gained from this pilot study, address the limitations, and continue to add to the science of nursing. Designing studies including other disciplines and/or other disease processes can provide more variables to test the hypothesis that IP communication and teamwork can reduce the time to rescue and improve patient outcomes.

Mixed Methods Design

A mixed methods design would enrich the study by giving a voice to the participants. Descriptive data would provide additional depth and rigor to the study. A mixed methods study would include the participant's point of view and may identify contradictions or correlations between the quantitative and qualitative results. Questions could be added to the survey to capture the participant's thoughts. Reflection during debriefing would align with the theoretical frameworks for the study. Identification of themes could expand the data related to nursing student perceptions of IP communication and teamwork, time to rescue, and patient outcomes.

Longitudinal Design

The addition of a longitudinal design interviewing graduates at the time of graduation and again after six-months of working as a registered nurse could provide rich data about how prepared the novice nurses felt in their role in the clinical area after practicing IP communication and teamwork as students. Interviewing registered nurses enrolled in a RN-BSN program could provide data of this type of program's exposure to interprofessional experience during pre-graduation clinical/simulation. Comparing their preparation for interprofessional communication and teamwork in a clinical setting with graduates from a baccalaureate program with intentional interprofessional simulations could provide data to support pre-graduate interprofessional experience.

Randomized Controlled Trial with Larger Sample Size

Repeating the study with a larger sample size would be optimal. This would be difficult to do at the same location where the pilot study was conducted, since class size is relatively uniform from semester to semester. One way to increase the sample size would be to conduct the study over multiple semesters. At least three semesters would be required to have the number of participants calculated by the power analysis. Students that were repeating the junior clinical course and had previously participated in the study would be excluded from being a participant a second time to not skew the results. Conducting the study at multiple academic simulation sites is another way to increase the sample size. It may be difficult to ensure that participants receive the same COPD and anxiety education, the simulation equipment is similar, and faculty and staff conduct the simulation the same way at each location.

Virtual Interprofessional Simulation

As healthcare programs include more virtual simulation in clinical nursing courses, design of studies to compare nursing student perceptions of effective interprofessional communication and teamwork on time to rescue during live simulation versus virtual simulation can be beneficial as nurse educators plan and design clinicals. Results could support inclusion of additional virtual simulation into clinical courses in the future. Exploring alternatives to actual clinical settings is important as nurse educators are finding fewer clinical sites for nursing students to get hands-on experience. Virtual simulation could become a viable alternative to clinical settings with live patients.

Conclusion

Failure to rescue and patient outcomes are of concern to regulatory agencies, employers, and nurses. Interprofessional education provides a way to address these concerns and produce graduate nurses who will be practice ready to reduce time to rescue and improve patient outcomes when they enter the workforce. Interprofessional communication and teamwork are skills that require practice to attain expertise. Interprofessional simulation education offers a unique environment for IPE scenarios created to challenge the student in situations they could encounter in a real clinical setting. Working alongside someone from another discipline, providing safe care together, and reducing the time to rescue a deteriorating patient have the potential to improve patient outcomes. Further research is required to provide the evidence to support claims that IP communication and teamwork improve patient outcomes.

Appendix A

BLESSING-RIEMAN
College of Nursing & Health Sciences

July 12, 2019

Dear Deborah Race:

I am pleased to offer my support for your research proposal "Nursing Student Perceptions of the Effects of Interprofessional Communication and Teamwork on Time to Rescue". As the President/CEO of Blessing-Rieman College of Nursing and Health Sciences (BRCN), I fully support this study using BRCN as a research site.

Simulation use in nursing education has increased due to difficulty in obtaining clinical sites. Simulation provides students a safe environment to experience a variety of clinical scenarios. Interprofessional simulation research is needed to evaluate the effects of simulation on patient outcomes. Again, I offer my full support for this much needed research.

I wish you success on this project and look forward to continued collaboration with you in the future.

Sincerely,

Brenda Beshears

Brenda Beshears PhD, RN
President/CEO
Blessing-Rieman College of Nursing and Health Sciences

Broadway at 11th Street • P.O. Box 7005 • Quincy, IL 62305-7005
217-228-5520 www.brcn.edu

Appendix B
Demographic and Survey Tool

The purpose of this survey is to allow you to describe your perception of communication and teamwork in interprofessional simulation. For the purpose of this survey, interprofessional is defined as a learning environment in which students and a member of another healthcare discipline learn/work together. Completing this survey is voluntary, should take about 5 minutes of your time, and your responses will remain confidential. All data will be summarized and reported in aggregate form. This makes it impossible to link any one response to an individual.

Demographics-Please circle the appropriate response

Gender: Male Transgender Male Female Transgender Female Prefer Not to Answer
Age range in years: 18-24 25-35 36-45 46 and older Prefer Not to Answer
Race: Caucasian African-American Latino Other Prefer Not to Answer
Educational Program: Baccalaureate Degree Associate Degree
Previous Interprofessional Experience: Yes No
If yes: Simulation during clinical Simulation during theory Both

Self-Assessment Teamwork Tool (SATT)
Place a check mark in the column that best describes your perception of teamwork during the simulation.

Perception of Teamwork in Interprofessional Simulation Education	**Poor 1**	**2**	**3**	**Average 4**	**5**	**6**	**Excellent 7**
Team members offered assistance to one another.							
Critical clinical actions were verbalized.							
Team members asked for suggestions when problem solving.							
Task implementation was well coordinated.							
When expressions of concern were raised and not responded to appropriately, team members took action.							
Questions were responded to appropriately.							
A plan for treatment was communicated to the team.							
Verbal communications were directed to individuals.							
When team members received instructions they closed the communication loop.							
Priorities were communicated to the team.							

Appendix C

Simulation Time Line

The simulation time line will provide a guideline for the simulation nursing faculty as the simulation begins, the simulated patient's condition changes, and the students begin to implement interventions.

- Two students arrive for each simulation room (control and intervention)
- Simulation nursing faculty for each simulation room will give report to the students
- Students enter room and introduce themselves to the simulated patient
- Students begin performing respiratory assessment
- Two minutes after the respiratory assessment begins, the simulation nursing faculty will manually change the simulated patient's vital signs, oxygen saturation rate, lung sounds, and anxiety level
    - Pulse-92, Respirations-32, Blood pressure-150/94, Oxygen saturation rate-88%, more crackles in the lungs, simulated patient 'says' he is anxious due to respiratory difficulty
- Two and one half minutes after the respiratory assessment begins, the respiratory therapist will arrive to the intervention room to perform a respiratory assessment
- The simulation nursing faculty will make changes to the simulated patient's status every two minutes after the initial change in condition
    - Standard interventions will include, but are not limited to: raising the head of the bed, increasing the oxygen flow rate, pursed lip breathing, monitoring vital signs, notifying the physician of the change in condition

and requesting additional orders (as needed nebulizer treatments and changing the anti-anxiety medication to the intravenous route), administration of anti-anxiety medication or other medications as ordered

    - The simulated patient's status will continue to deteriorate if the students do not implement expected standard interventions for a noted change in respiratory status and anxiety
    - The simulated patient's status will improve if the students implement expected standard interventions for the noted change in respiratory status and anxiety

- The simulation will end when the simulated patient's oxygen saturation rate returns to 90%, the simulated patient experiences a respiratory arrest, or 15 minutes have passed

Appendix D

Role of the Respiratory Therapist

The respiratory therapist (RT) will be a member of an interprofessional team with two nursing students assigned to provide care for a simulated chronic obstructive pulmonary disease (COPD) patient experiencing an acute exacerbation of their respiratory condition. The RT will arrive at the simulation room assigned to the intervention group to perform a respiratory assessment two and one-half minutes after the oxygen saturation rate falls below 90%. The role of the RT in the simulation scenario is that of a team member, not a team leader. The RT would be expected to perform the following functions related to the RT role:

- Identify self by name and title
- Perform own respiratory assessment of the simulated patient
    - Pulse, respiratory rate, oxygen saturation, lung sounds
    - Short of breath, using accessory muscles, cyanosis, diaphoresis
- Determine what interventions the nursing students have implemented
    - Done so as to not repeat standard interventions
    - May ask if there are any additional planned nursing interventions/orders
    - May not give directions/suggestions for nursing interventions
- Review physician orders for the simulated patient
    - Will reveal there is no as needed order for a bronchodilator nebulizer treatment
- Assist the nursing students to implement interventions that are common to either role
    - Elevate the head of the bed
    - Increase the oxygen flow rate
    - Practice pursed lip breathing

- Request obtaining an order for a stat/as needed bronchodilator nebulizer treatment order and administer if order obtained

Appendix E

Senior Level Nursing Student Volunteer

The senior level nursing student volunteer was available as 'extra hands' with two nursing students randomized to the control group and assigned to provide care for a simulated chronic obstructive pulmonary disease (COPD) patient experiencing an acute exacerbation of their respiratory condition. The senior level nursing student volunteer will be available to the control groups during the simulation once the oxygen saturation rate drops below 90%. The role of the senior level nursing student volunteer in the simulation scenario is to review student interventions that have been implemented and effects on the patient's respiratory status if asked by the participants. The senior level nursing student volunteer is not to take over the simulation or function as a team leader. The senior level nursing student volunteer was expected to perform the following functions related to his/her role:

- Identify self to the simulated patient by name and title
- Determine what interventions the nursing students have implemented
    - Give no directions/suggestions for nursing interventions
- Ask the nursing students what standard nursing implementations have been implemented
    - Elevate the head of the bed
    - Increase the oxygen flow rate
    - Practice pursed lip breathing
- Ask the nursing students if there are any additional implementations needed

Appendix F

Time to Rescue Log

The research assistant will enter the date, participant by number, and 'A' or 'B' in the appropriate columns before the simulation begins. The research assistant will remove all non-participant data with a black marker after the simulations are completed for the day.

The simulation nursing faculty will complete the remaining columns as the simulation scenario unfolds. The simulation nursing faculty will give the sheet to the research assistant at the end of all simulation scenarios for each day.

Date	Participants (by ID number)	Control (A) Intervention (B)	Time Oxygen Saturation Declines to 89% (2 minutes after simulation begins)	Time oxygen saturation improves to 90% or above or respiratory arrest (15 minutes or less from desaturation)	Total Time to Rescue	Outcome (Oxygen saturation 90% or higher (OS) or respiratory arrest (RA))

Appendix G

Consent for Participation in a Research Study

Nursing Student Perceptions of the Effects of Interprofessional Communication and Teamwork on Time to Rescue

Carol Schmer, PhD, RN
Deborah Race, PhD(c), RN

Request to Participate

You are being asked to take part in a research study. This study is being conducted at Blessing-Rieman College of Nursing and Health Sciences (BRCN).

The researcher in charge of this study is Carol Schmer, PhD, RN. While the study will be run by her, other qualified persons who work with her may act for her.

The study team is asking you to take part in this research study because you are a nursing student enrolled in a clinical course at BRCN. Research studies only include people who choose to take part. This document is called a consent form. Please read this consent form carefully and take your time making your decision. The researcher or study staff will go over this consent form with you. Ask him/her to explain anything that you do not understand. This consent form explains what to expect: the risks, discomforts, and benefits, if any, if you consent to be in the study.

Background

This study will explore the effect of interprofessional communication and teamwork on time to rescue a simulated patient experiencing a deterioration in respiratory status.

This study is recruiting all pre-licensure nursing students enrolled in a junior level clinical course at BRCN.

You will be one of about 50 subjects in the study at BRCN.

Purpose

The purpose of the study is two-fold. First, to explore nursing student perceptions of whether interprofessional (IP) communication and teamwork has any effect on time to rescue a simulated patient with a deteriorating respiratory status. Secondly, to explore whether IP communication and teamwork reduces time to rescue a simulated patient with a deteriorating respiratory status, thus improving the simulated patient outcome. The study will address gaps in the science of nursing related to IP communication and teamwork, time to rescue, and potential effects on patient outcomes.

The study seeks to answer the questions: 1) how do nursing students perceive IP communication and teamwork effects on the time to rescue a deteriorating simulated patient? 2) what effect does IP communication and teamwork have on time to rescue a deteriorating simulated patient?

Procedures

Participants will be randomly assigned to the experimental or control group. You will have a 1 in 2 chance of being assigned to the experimental group. Participants will be in a simulated experience caring for a patient in respiratory distress.

After consenting to participate in the study, you will be asked to complete the activities described below. These activities will take place during your regularly scheduled simulation time.

After providing consent to participate in the study, participants in the experimental group will be asked to read an educational sheet related to interprofessional communication and teamwork. All participants will be asked to complete two instruments after the simulation is completed and prior to debriefing. It will take about 5 minutes to complete the instruments. The instruments to be completed are:

- Demographic Form
- Self-Assessment Teamwork Tool

Simulation Visit

The simulation experience will take place in the Simulation Center during your scheduled simulation experience. Each simulation session will be video recorded per normal simulation center practice. Video recordings will not be used for the research study. The researchers will not have access to the video recordings at any time. Video recordings will be deleted two weeks after the beginning of the following semester per normal simulation center practice.

If you agree to take part in this study, you will be involved in this study for approximately one day. Study participation will begin after providing consent and end after the scheduled simulation experience. When you are done taking part in this study, you will not still have access to the study treatment/intervention.

Participation in this study is completely voluntary. No faculty member will know if you participated or did not participate in the study. You can withdraw from the study at any time by either not completing the study instruments or by contacting the research assistant, Erica Alexander at alexandera@brcn.edu or 217.228.5520 ext. 6956.

Risks and Inconveniences

This research is considered to be minimal risk. That means that the risks of taking part in this research study are not expected to be more than the risks in your daily life. There are no other known risks to you if you choose to take part in this study. If you do experience psychological distress from this activity counseling services are available. The College social worker is available to counsel students and can make the determination to refer individual students for additional free counseling services if necessary.

Benefits

There are no benefits to you for taking part in this study.

Other people may benefit in the future from the information about interprofessional communication and teamwork effects on time to rescue and patient outcomes that comes from this study. The study will provide nurse educators with further information regarding interprofessional simulation.

Fees and Expenses

There are no costs to participate in this study.

Compensation

There is no payment for taking part in the study.

Alternatives to Study Participation

The alternative is not to complete the study instruments. All students will complete the simulation experience as it is a course requirement.

Confidentiality

While we will do our best to keep the information you share with us confidential, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study to make sure we are doing proper, safe research and protecting human subjects. The results of this research may be published or presented to others. You will not be named in any reports of the results.

Only Erica Alexander will have access to study information that identifies the participants. This information will be stored in a locked cabinet that only Erica Alexander will be able to access. Erica Alexander will ensure study instruments do not contain any identifying information prior to giving the instruments to Deborah Race.

Only Deborah Race will have access to the de-identified information. This information will be kept in a locked cabinet that only Deborah Race will be able to access. The data will be entered into IBM SPSS to be analyzed. Only Deborah Race will have access to the electronic data.

Contacts for Questions about the Study

You should contact the Office of UMKC's Institutional Review Board at 816-235-5927 if you have any questions, concerns or complaints about your rights as a research subject. You may call the researcher, Deborah Race at 217.228.5520 ext. 6910 if you have any questions about this study. You may also call her if any problems come up.

Voluntary Participation

Taking part in this research study is voluntary. If you choose to be in the study, you are free to stop participating at any time and for any reason. If you choose not to be in the study or decide to stop participating, your decision will not affect your education or course grade. If you choose to withdraw from the study, contact Erica Alexander at alexander@brcn.edu or 217.228.5520 ext. 6956. The researchers may stop the study or take you out of the study at any time if they decide that it is in your best interest to do so. They may do this for administrative reasons or if you no longer meet the study criteria. You will be told of any important findings developed during the course of this research.

You have read this Consent Form or it has been read to you. You have been told why this research is being done and what will happen if you take part in the study, including the risks and benefits. You have had the chance to ask questions, and you may ask questions at any time in the future by calling Deborah Race at 217.228.5520 ext. 6910. By signing this consent form, you volunteer and consent to take part in this research study. Study staff will give you a copy of this consent form.

____
Last 4-digits of phone number

____
Birth month/date (mmdd)

____
Signature (Volunteer Subject)

____
Date

____
Printed Name (Volunteer Subject)

____
Signature of Person Obtaining Consent

____
Date

____
Printed Name of Person Obtaining Consent

Appendix H

Intervention Group Teamwork Pre-Briefing

Healthcare professionals who participate effectively and appropriately in an interprofessional (IP) healthcare team are able to:

Describe competencies, roles, expertise, and overlapping scopes of practice of all team members and identify gaps that need to be addressed,

Describe individual and team roles and responsibilities in the context of practice and in the healthcare system,

Demonstrate respect for all team members, including the patient and his/her family,

Work to develop a shared set of individual and team values, rights, and responsibilities,

Identify and act on safety issues, priorities, and adverse events in the context of team practice.

Healthcare professionals who meaningfully engage patients as the central participants in their healthcare teams:

Ensure that patients are at the center of care,

Engage patients in decision-making and the management of their own health,

Provide appropriate, sufficient, and clear information, and teaching to patients to support informed decision-making,

Advocate for individual patients and for the resources to be able to provide patient-centered, high quality care,

Respond to individual patient needs and respect cultural and personal health beliefs and practices.

Healthcare professionals who appropriately share authority, leadership, and decision-making for safer care:

Explain their role in patient care to team members and patients,

Collaboratively consult with, delegate tasks to, supervise and support team members,

Ask for support when appropriate,

Encourage team members to speak up, question, challenge, advocate, and be accountable to address safety issues and tasks inherent in the system,

Demonstrate leadership techniques appropriate to clinical situations.

Work with other team members to prevent conflicts:

Define and identify conflict in healthcare teams, Work with other team members to prevent conflicts,

Employ collaborative negotiation to manage conflicts in the team,

Employ collaborative negotiation to manage conflicts in the team,

Respect differences, misunderstandings, and limitations that may contribute to IP tensions,

Demonstrate willingness to set team goals and priorities, measure progress, and learn from experience together as a team,

Address all practice variations that can dilute the reliable delivery of evidence-informed care.

Appendix I

Report for Students

Time: 0800

Situation:
Mr. Williams is a 59-year old male patient who was admitted during the night with an acute exacerbation of chronic obstructive pulmonary disease (COPD).

Background:
He has a history of depression and anxiety.

Assessment:
Blood pressure: 130/70
Heart rate: 88 per minute
Respiratory rate: 24-28 per minute
Pulse oximeter: low 90's w/oxygen at 2/Liters via nasal cannula
Afebrile
Lungs diminished with minimal crackles throughout
Productive cough with yellow sputum
Short of breath with exertion
Chest x-ray shows pneumonia
Saline lock needle present
Requires minimal assistance with activities of daily living
Last scheduled nebulizer (respiratory) treatment at 0600

Recommendation:
Complete a full respiratory assessment and intervene as patient's condition warrants.

Electronic Medical Record:
Lorazepam 1 mg every 4 hours, as needed for anxiety (none administered)
Ceftriaxone 1 gram intravenous every 24 hours (has not been administered)
Prednisone 5 mg by mouth daily (not administered)
Paroxetine 30 mg by mouth daily (not administered)
Albuterol nebulizer every 4 hours (administered at 0600)

Appendix J

Interprofessional Communication and Teamwork Debriefing Questions

Debriefing will be facilitated by the simulation nursing faculty members and the clinical nursing faculty member and will allow each participant to share their own thoughts and experiences that occurred during the simulation. The simulation nursing faculty and the clinical nursing faculty will include the following debriefing questions to facilitate discussion related to interprofessional communication and teamwork encountered during the simulation scenario.

- How well did your team function during the simulation?
- How did having someone from another discipline (or extra hands) influence intervention decisions?
- How did this simulation contribute to your confidence in working with someone from another discipline?
- How will this experience impact/affect your practice in the clinical area?

Appendix K

Permission to Use Self-Assessment Tool

Dear Deborah,

Thank you for your email.

I am very happy for you to use the self-assessment tool, thank you for asking. From memory, all of the psychometrics are in the paper, you will find reliability and validity details. There are two relevant papers where we have revalidated the tool:

https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-016-0743-9
https://www.tandfonline.com/doi/abs/10.1080/0142159X.2017.1418849

All the best with your studies.

Regards,
Chris

Appendix L

Institutional Review Board Approval

October 18, 2019

Principal Investigator: Carol Elizabeth Schmer
Department: Nursing - General

Your IRB Application to project entitled "Nursing Student Perceptions of the Effects of Interprofessional Communication and Teamwork on Time to Rescue" was reviewed and determined to qualify for IRB exemption according to the terms and conditions described below:

IRB Project Number 2017605
IRB Review Number 254441
Initial Application Approval Date October 18, 2019
IRB Expiration Date N/A
Level of Review Exempt
Exempt Categories 45 CFR 46.101b(1)
Risk Level Minimal Risk

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the determination:

1. No subjects may be involved in any study procedure prior to the determination date.
2. Changes that may affect the exempt determination must be submitted for confirmation prior to implementation utilizing the Exempt Amendment Form.
3. The Annual Exempt Form must be submitted 30 days prior to the determination anniversary date to keep the study active or to close it.
4. Maintain all research records for a period of seven years from the project completion date.

If you are offering subject payments and would like more information about research participant payments, please click here to view the UM system Policy on Research Subject Payments: https://www.umsystem.edu/oei/sharedservices/apss/nonpo_vouchers/research_subject_payments
If you have any questions, please contact the IRB at 816-235-5927 or umkcirb@umkc.edu.

Thank you,
UMKC Institutional Review Board

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VITA

Deborah Ann (Erb) Race was born in Washington, Missouri in 1956. She lived with her family in Beaufort, Missouri until 1974. She attended and graduated from Union High School in 1974. Ms. Race graduated from John Wood Community College in 1982 as a licensed practical nurse. Prior to attending college, Ms. Race worked in local nursing homes.

Ms. Race continued her nursing career by attending Blessing Hospital School of Nursing in Quincy, Illinois. After graduation from the diploma school in 1987, she began her professional nursing career on a Medical-Surgical/Oncology unit at Blessing Hospital in Quincy, Illinois. Ms. Race returned to school and graduated with a Bachelor of Science in Nursing degree from Culver-Stockton College in Canton, Missouri and Blessing-Rieman College of Nursing in Quincy, Illinois in 1992. Ms. Race had the opportunity to become a house supervisor on the night shift at the hospital in 1990. After eight and a half years, she wanted to move to a day shift position. She accepted a position as the Medicare biller for the Skilled Nursing Unit in 1998.

It was during her tenure on the Skilled Nursing Unit that she decided to again return to school. She earned a Master of Science in Nursing degree from the University of Phoenix in 2009. She accepted a position at Blessing-Rieman College of Nursing as a clinical adjunct. It was during that semester that she developed a desire to teach and accepted a full time instructor position with the college. She began teaching a junior level Medical-Surgical nursing course in January 2010, which she continues to teach. Ms. Race has developed two elective courses and a gerontology course over the course of her time at the college. She began teaching on-line courses in 2018. Ms. Race holds nursing licenses in both Missouri and Illinois.

Ms. Race was promoted to Assistant Professor in 2013 and Associate Professor in 2017. She was nominated for and was awarded the first Daisy Faculty Award in 2013. She received the

American Nurses Association-Illinois (ANA-IL) Pinnacle Leader Award in 2015. Ms. Race is a member of ANA-IL, the National League of Nursing, Sigma Theta Tau International Nursing Honor Society, and the Pi Pi Chaper of Sigma Theta Tau International Nursing Honor Society. She was a co-investigator in a research study in 2010. She was the primary investigator in a study on digital audio feedback in 2015. She has presented her research locally, regionally, and nationally. She was a co-author of an article in 2015 with colleagues at the college related to the topic of using a real apartment for home visit simulations. Her article on digital audio feedback was published in *CIN: Computers, Informatics, and Nursing* in 2018. After completing the Doctor of Philosophy degree, Ms. Race plans to continue her interprofessional research in nursing education, hoping to demonstrate improved patient outcomes using an interprofessional approach to patient care.