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Improve Intra-Operative Nurse-to-Nurse Communication Using a Safety Checklist

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ABSTRACT

IMPROVE INTRA-OPERATIVE NURSE-TO-NURSE COMMUNICATION USING A SAFETY CHECKLIST

Poor and inadequate handoff, or transfer of care of the surgical patient care from the primary to the relief operating room registered nurse circulators, can result in irreversible patient harm, or sentinel events, such as retained foreign items. In this study, Rogers' diffusion of innovation theory was the framework for implementing the handoff safety checklist. Also, Donabedian's structure process and outcome was the model to investigate the feasibility, acceptability, and improvement in the quality of patient handoff communication and improvement of nurse satisfaction over time. Nineteen-statement surveys, conducted at multiple timeframes, were completed by volunteer operating room nurse participants. In comparison, outcomes of the pre-intervention and post-intervention surveys illustrated significance in the quality of nurse communication and satisfaction of the handoff safety checklist. The value of standardized handoff safety checklists is evident in the study. However, further research of handoff safety checklists in the intraoperative arena is warranted.

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DEDICATION

I also dedicate this paper in memory of my Mom, Alejandria Tadeo, who encouraged me to always reach to my potential, and to which I am forever grateful. Mom, you are always in my heart.

TABLE OF CONTENTS

LIST OF TABLES

Page

IMPROVE INTRA-OPERATIVE NURSE-TO-NURSE COMMUNICATION USING A SAFETY CHECKLIST

Introduction

Clear, concise, and accurate handoff communication between members of the operating room (OR) team is integral to the safety of the surgical patient. In a busy OR environment, efficient and effective handoff communication is crucial. A handoff is an exchange of pertinent patient information and transfer of patient care between healthcare givers (Gregory, 2006). In nurse handoffs, the depth of information communicated and quality of the handoff is dependent on the reporting nurse.

Literature of an observational study of handoff communication in the OR, conducted by Lingard et al. (2004), affirmed that insufficient and incorrect information during handoff resulted in communication failure. Other barriers identified by Lingard et al. (2004) were lack of teamwork, limited situational awareness among OR team members, and poor leadership support. Perioperative literature also identified that interruptions and distractions from staff members, computers, and telecommunication devices were common in the daily workflow of the OR nurse (Seifert, 2012). Such occurrences at the nursing handoff have contributed to sentinel events, such as incorrect medication administration, surgical site infections, wrong-side or site surgery, and retained surgical items.

As a result, the operating time can be longer and patients may experience greater physical discomfort, emotional trauma, and increased financial burden from longer hospitalizations and additional procedures, surgeries, medications, treatments, or therapies.

Problem

The significance of concise and accurate handoff communication was realized when it contributed to approximately 400 reviewed surgical malpractice claims (Greenberg et al., 2007). Its importance was further underscored when The Joint Commission (TJC) released a statement that 80% of medical errors in the United States were due to poor communication (Seifert, 2012). The 2006 National Patient Safety Goals, released by TJC highly, recommended patient care handoff communications be clear, with correct information of current or anticipated changes of patient's health and treatment modalities (Paine & Millman, 2009). TJC developed a pre-procedural *time out* conducted prior to an invasive patient procedure or the surgical incision to confirm the correct patient, procedure, and procedure or surgical site and/or side. Healthcare institutions also developed a *debriefing* that is initiated at the end of the surgery to identify processes that went well or needed improvement.

Aside from pre- and post-procedural dialogue, checklists were created as safety tools. One commonly identified tool in the systematic literature review of nurse handoff is a mnemonic checklist (Riesenberg et al., 2010). The concept of a safety checklist was adopted from the commercial aviation industry that had its airline pilots use pre-flight safety checklists before takeoff. Adopting this concept, Harvard trained surgeon, Dr. Atul Gawande, in collaboration with the World Health Organization (WHO), developed a surgical safety checklist and guidelines for surgical safety (Low et al., 2012). The surgical checklist provides essential elements of patient or procedure information shared among the OR team before the surgical incision. Lingard et al.'s 2004 observational study of OR communication exchanges recommended innovations for communication improvement, such as the briefing, safety checklist, and debriefing, which are

innovations to improve the handoff process. Yet, poor handoff communication persists and the the surgical patient is vulnerable in the OR environment.

One alarming risk of OR communication error happens during permanent handoff between the primary and relief circulating nurses. Critical information missed during a random exchange handoff communication disintegrates nursing confidence and satisfaction of the handoff process. Therefore, the lack of a standardized handoff process further results in poor patient outcomes and risk to patient safety.

Purpose

A simple and easy hand off tool can effectively improve communication and safeguard the patient from harm. The dual purpose of this study is, first, to implement a standardized handoff safety checklist (HSC) used by OR nurse circulators during permanent patient care handoff. Additionally, it is to improve quality of communication and nurse satisfaction during the handoff process. Rogers' diffusion of innovation theory (DIT) was used to implement the HSC and Donabedian's structure, process, and outcome (SPO) theory was the framework to determine an improvement in the quality of the nurse communication and nurse satisfaction of the handoff process. Therefore, the implementation of the HSC should improve patient outcome and decrease the risk to patient safety by improving the quality of the nurse communication process and nurse satisfaction.

Theoretical Framework

Rogers' Diffusion of Innovation Theory

The DIT is the distribution and application of new or newly perceived concepts, processes, or services within the breadth of an organization (Lundblad, 2003). The concept originated in 1903 with French sociologist Gabriel Tarde, and was studied by multiple

academicians, theorists, and researchers, including Everett Rogers (Kaminski, 2011). Crediting the work of the numerous theorists, Rogers published the concepts and findings of the DIT in 1962 (Kaminski, 2011). His publication captured the attention of various organizations in areas of education, human resources, sociology, management, and healthcare. Rogers' DIT has been used by healthcare organizations to implement new innovations. Yet, administrative policies, lack of leadership support or commitment, or government healthcare regulations have stalled or blocked worthwhile innovations (Stelk, 2006). These barriers can be overcome when the innovation is established with a scientifically based implementation theory, such as Rogers' DIT (Stelk, 2006).

Assumptions

The essential elements of Rogers' DIT are innovation, organizational structure, process of communication, and time (Lundblad, 2003). These unique elements are suited to implement the HSC. The theory's assumption of an innovation is that it is new or newly perceived by the adopter, and the adoption of the innovation is dependent on the complexity of its design (Berwick, 2003). A simple and uncomplicated innovation is understood for its purpose and benefits, easily implemented, and visibly observed or evaluated by the adopter. It further supports and aligns with the adopter's personal or professional needs, values, and beliefs, therefore is readily embraced (Berwick, 2003). For these reasons and for the purpose of the project, a mnemonic checklist was developed and implemented, which, according to the nurse handoff systematic literature review, was a commonly identified communication tool (Riesenberg et al., 2010).

The second element of communication predicts that the communication process within the structure of the organization contributes to the rate of acceptance and adoption of an

innovation (Lundblad, 2003). Electronic mail, post-office mail, mass media, or social media are methods of communication by which information is shared. With face-to-face communication, the speaker can influence the rate of adoption by showing enthusiasm and candor in his delivery. Within a similar concept, and based on studies conducted by Greenberg et al. (2007) and Lingard et al. (2004), handoff communication failures have contributed to patient harm and the breakdown in communication can also deter the adoption of innovation. Regardless of the method of communication, the content of information must be consistent and equally understood by potential adopters, who can then share their knowledge with those who are uninformed (Stelk, 2006).

The third assumption is that the social system or structure of the organization contributes to its adoption (Lundblad, 2003). The social system within the organization can include the formal and informal leaders that influence decisions. The formal leaders are key stakeholders of the organization that comprehend the fundamental premise and benefits of the innovation and demonstrate their support. The informal leaders are individuals without a formal administrative title, although are respected and trusted from their peers thus command attention and are influential.

The theory's last assumption is that the amount of time the innovation takes to adopt is directly related to the rate of influence or support from the organization's leaders (Stelk, 2006). Individuals with similar ideals and goals, who foresee the potential advantage of the innovation, are enthusiastic and motivated to start, in contrast to individuals with uncertainty and hesitation. Early adopters are willing to take risks and search for additional information (Stelk, 2006). Early adopters are usually professionally and socially networked and firmly confident the value of the innovation is aligned with their own professional beliefs and needs (Berwick, 2003). In contrast,

late adopters prefer to wait and observe, tend to need some persuasion from colleagues, or altogether do not comprehend the principles of the innovation.

Rogers' DIT has been used in the healthcare environment and academic institutions to implement innovations, concepts, or ideas. As an example, Rogers' DIT was used at Washington State University to successfully integrate simulation learning in their nursing program (Starkweather & Kardong-Endgren, 2008). To gain nursing faculty buy-in and increase the interest in simulation, the university invited a group of nursing faculty to observe a simulation exercise and debriefing. As a result, interest was awakened in other nursing faculty members who had been hesitant or unfamiliar with simulation and, overall, the group agreed that simulation was advantageous to the student-learning experience. Another example was the rapid improvement process (RIP) workshop, conducted at Seattle Children's Hospital in Washington to implement an OR safety checklist (Low et al., 2012). Invited to the workshop were anesthesiologists, surgeons, OR nurses, and surgical technicians from the OR team who were crucial to the success of the innovation. The information from the RIP workshop garnered enthusiasm as a group to implement the checklist. Subsequently, the information from the workshop and plans to implement the innovation were enthusiastically spread to other members of the OR unit social system.

The use of Rogers' DIT to implement the HSC in the OR is appropriate for the innovation and is within the elements of the theory. The checklist, although not new in the realm of healthcare, is new to the OR nurse participants of the project. For this purpose, face-to-face communication was used to present the HSC to a large group of nurses at the OR hospital and ASU staff meeting. The nurses were provided with and heard the same information that emphasized patient safety and simple use of the checklist. The presentation was carefully

planned to ensure that the delivery of information was clear and conducive to questions. Keeping this in mind, garnering the support from the OR leadership was necessary to further the innovation's acceptance and rapid adoption by the OR nurses.

Donabedian's Structure-Process-Outcome Theory

The quality component of the HSC project is driven by Avedis Donabedian's SPO theory. A respected physician, Donabedian pioneered the need for quality improvement in healthcare by stressing the importance of improving healthcare delivery processes and patient outcomes through quality improvement efforts (Glickman, Baggett, Krubert, Peterson, & Schulman, 2007). Donabedian believed quality is defined by the current standards, values and focus of healthcare and medical systems, and the general public (Donabedian, 2005). He also believed quality is measured by outcomes as a result of the relationship between the structure of the healthcare system and the processes of healthcare delivery (Glickman et al., 2007). Donabedian's life work in quality has been the foundation of subsequent quality improvement efforts in healthcare and medicine. Hence, the quality assessment of the SPO of the HSC is based on Donabedian's SPO theory. The assessment includes the setting of the nurse-to-nurse HSC (structure), the implementation of the checklist (process), and the influence of the HSC to nurse communication and satisfaction of the handoff process (outcome).

Assumptions

Donabedian's theoretical assumption is that patients receive better healthcare in an organization housed in a new physical setting, with state-of-the-art medical technology and a wealth of financial and human resources (Donabedian, 2005). However, it is essential that the deeper layers of the healthcare system's structure is considered, such as the healthcare givers and providers' skills and competencies of the system's administrative and clinical processes because

of its tremendous influence on the patient's outcome (Campbell, Roland, & Buetow, 2000). Other considerations are the organization's mission, vision, philosophy, beliefs and values, employee motivation, and leadership skills and attributes (Glickman et al., 2007).

A study to determine the safety and quality of patient care provided by the nurse practitioners (NP) in Queensland, Australia demonstrated the importance of structure as it applies to Donabedian's theory (Gardner, Gardner, & O'Connell, 2013). At the start of the Queensland project, there was confusion with the NP role among other healthcare clinicians. The teams' confusion influenced the outcome of the study, thereby illustrating the need to strengthen the structure of the project by clarifying the role of the NP (Gardner et al., 2013). Another example of structural depth was the research in the integration of cultural competence and cultural safety to the undergraduate nursing curriculum conducted at three Anglophone schools of nursing in Canada (Rowan et al., 2013). It found that faculty need to be knowledgeable on cultural competence and safety in preparation for these concepts to be integrated into the nursing curriculum.

Assessment of the healthcare process is the second pillar of Donabedian's SPO theory. For example, the assumption is that state-of-the-art technology facilitates better health care (Donabedian, 2005). In fact, the value of high cost technology derives from the quality and accuracy of the results it provides and the interpretation of the results by the healthcare providers. Donabedian believed that greater consideration of patient needs are to be supported and validated by data and patient assessment or evaluations (Donabedian, 2005). The information obtained can then be fully and accurately shared to provide seamless transition of patient care from one healthcare individual to another. Hence, the quality of the verbal communication is essential, as illustrated by a study conducted by Greenberg et al. (2007). They

reviewed surgical malpractice claims and determined that 92% of the errors committed derived from verbal communication failures.

The third assumption of Donabedian's SPO theory is that patient outcomes validate the quality and efficacy of patient care provided by the healthcare individual (Donabedian, 2005). However, Donabedian cautioned that outcomes are influenced by significant factors such as patient participation in his own care or patient satisfaction that contribute towards a valid outcome measure (Donabedian, 2005). He further inferred that outcomes are reliant on the individual's attitude or satisfaction, which can be vague (Donabedian, 2005). A study in the quality of nursing care was conducted at 63 nursing care units at 15 hospitals in Japan from 2005 to 2006 (Kobayashi, Takemura, & Kanda, 2010). Quality of nursing care was measured by the patients' perceived comfort of the patient care environment, patient-nurse relationship and interaction process, and nursing care. The survey results demonstrated an increase in patient satisfaction of nursing care, though they also warranted further exploration in the improvement of nursing care in a hospital setting (Kobayashi et al., 2010).

Donabedian's SPO model for determining the measure of improvement in the quality of nurse communication and nurse satisfaction of the handoff process is suitable. The three components: structure, process, and outcome, are all interrelated to obtain a true result. The simple use the handoff checklist in the OR does not ensure improved quality of communication or nurse satisfaction of the patient handoff process. The physical setting of the OR has minimal influence on the quality of the handoff checklist's outcome, whereas an assessment of the formal and informal leadership, teamwork, nurse competence, and skill level is more indicative of a true outcome. Process, as defined within the sphere of the project, is the nurses' knowledge and

understanding of the purpose and safety benefits of the checklist, integration, and use into the nursing workflow.

Literature Review

There is a wealth of literature on the barriers and possible solutions of handoff communication. The literature illustrates the power of ineffective communication in the healthcare domain and the impact on patient safety. In the OR, communication errors can lead to sentinel events. A review of literature on the importance of an accurate and effective handoff communication is summarized. The articles include one systematic review of nursing handoff literature, one observational study, and surgical malpractice reviews.

An observational study was conducted to identify specific causes of communication failure in the operating room (Lingard et al., 2004). This study was part of a larger project to implement a handoff checklist. A total of 90 hours of observation during a total of 48 surgical cases were conducted by trained observers (Lingard et al., 2004), involving anesthesiologists, surgeons, surgical residents, fellows, nursing staff, and ancillary staff in the OR. The observers witnessed 421 communication exchanges, and from these exchanges, 129 were identified as communication failures (Lingard et al., 2004). It was determined that the cause of the failed communication was a lack of content and accuracy and unspecified purpose and effect of the communication (Lingard et al., 2004). The researchers recommended improved efficacy of communication between two healthcare providers or givers. The primary finding and recommendations from the study support the importance of thorough and accurate communication in an OR environment and aligns with the purpose of this project.

A systematic review of nursing handoff literature identified the barriers to poor information exchange and effective practices towards improved communication. Ninety five research articles were reviewed from January 2006 to August 2008 on handoff communication (Riesenberg et al., 2010). Included in 35% of the articles were descriptions of mnemonic tools

used during handoff communications. The findings identified communication barriers, including omissions, inaccuracies, interruptions, disruptions and poor recall, and disorganization of reported information. The primary discovery was that successful handoffs require effective communication for both the giver and receiver. Hence, a standardized communication process was described as the most frequent strategy recommended and used (Riesenberg et al., 2010). The major finding of this systematic review further supports that poor communication results from inaccuracies and/or missing information. Again, the inaccuracies and omissions of information during handoff communication cited in the literature is further evidence for the need of the HSC project.

Another interesting article reviewed 444 surgical malpractice claims that resulted from communication failures (Greenberg et al., 2007). About 92% of the verbal communication failures occurred with one person receiving and one person giving the information (Greenberg et al., 2007). These claims were from 46 hospitals with four healthcare insurers. From the 444 claims, 258 resulted in patient surgical injuries, and 60 of the 258 claims resulted from communication failure (Greenberg et al., 2007). Specifically, 49% of the errors represented unspoken communication errors and 44% represented inaccurate information (Greenberg et al., 2007). Based on the claims review, interventions to improve perioperative communication for the purpose of preventing patient injury will be recommended. The most compelling findings of these reviews identified that 43% of handoffs resulted in communication failures (Greenberg et al., 2007). The discoveries and results of the malpractice claims illustrate and significantly support the need for improved handoff communication with an implementation of an innovation or intervention.

To underscore the gravity of poor communication, in an attempt to temper or eliminate communication errors, financial penalties were imposed to healthcare organizations. The Centers for Medicare & Medicaid Services (CMS) listed unintended retained foreign items and surgical site infection after orthopedic, coronary artery bypass graft, and bariatric surgery in the list of 10 hospital-acquired conditions (HACs) (McHugh, Van Diyke, Osei-Anto, & Haque, 2011). In 2008, CMS limited hospital reimbursements for treatments to patients with HACs (McHugh et al., 2011). On July 2011, the federal government stopped paying hospitals for HAC treatment, and at the beginning of 2015, hospitals reporting increased numbers of patients with HAC conditions were penalized with a 1% reduction of Medicare reimbursements (McHugh et al., 2011).

Methodology

Careful planning was undertaken to develop the HSC research. All the elements that could influence the outcome of the project were considered, such as the template design, support from leadership to implement the project, and the acceptance and adoption of the OR nurses to the checklist. The methodology is outlined and described to illustrate the implementation of the HSC.

Design

The HSC study was socialized at unit huddles, in a memo, and flyers posted in the hospital OR and ambulatory surgery unit (ASU). The introduction of the project, presentation of the laminated checklist, pre- and post-intervention surveys, and request for volunteer OR nurse participants were conducted at the hospital OR and ASU staff meetings. Signed consents to participate in the nursing research study were obtained after the meetings without the presence of the student researcher. The volunteer nurses were separated into groups A and B: Group A used the HSC and represented hospital OR nurse participants. Group B did not use the HSC and represented ASU nurse participants. Group A was instructed to implement the laminated HSC during orthopedic and general surgery procedures when the nurse circulator was permanently relieved. Both these specialties were selected because of their large volume of scheduled cases that have surpassed other surgical services. Both groups completed pre-intervention and 4-week and 8-week post-intervention paper surveys that were labeled accordingly. Without the presence of the student researcher, the nurse participants signed consents to participate and completed the pre-intervention surveys that were then inserted into a manila envelope. At the end of the 4 and 8 weeks, post-interventions surveys were placed at accessible areas in the hospital OR and ASU for the nurse participants to complete and place in a manila envelope for collection.

Setting

The setting is a 240-bed hospital and free standing ASU that is part of a large healthcare management organization in San Jose, California. The hospital OR department contained seven surgery suites, and the ASU contained five surgery suites. Surgical procedures scheduled in the hospital OR covered, in general, surgery, gynecology, spine, urology, plastics, and orthopedics, including total joint replacements, vascular, and spine. Similar general surgery, gynecology, urology, and complex orthopedic procedures in the realm of sports medicine are performed on an outpatient basis in the ASU.

Sample Population and Protection

Preapproval was obtained from the local hospital executive leadership, regional quality improvement department, and the organization's Institutional Review Board committee. Selection of nurse participants was limited to OR registered nurses strictly on a volunteer basis to ensure equitability and participant protection. No participant identifiers were on the surveys to protect individual privacy. Also, to ensure their rights and welfare as participants, the nurses could withdraw from the study at any time. There was minimal risk to the nurse participants and substantial benefit to patients in the form of increased safety from the use of a standardized handoff tool.

Recruitment was conducted via staff meetings, huddles, memos, and posted flyers. Volunteer participants at both settings needed at least one year of experience as an ORN. The project was formally introduced and presented at the hospital OR and ASU staff meetings. Participants were both male and female, and had either associate's or bachelor's degrees in nursing. The nurses' OR experience ranged from 5 to 30 years, and involved either formal perioperative programs or on the job training.

The sample size was based on a convenience sample for this pilot study. The study aimed to implement a HSC and investigate the feasibility, acceptability, and improvement in the quality of patient handoff communication and improvement of nurse satisfaction, over time, using a safety checklist. There were a total of 35 prospective volunteer OR nurses at the hospital and ASU settings, with an anticipated sample size of 15 in groups A and B. A total of 19 OR nurses completed the surveys.

Innovation and Instrument

Handoff Safety Innovation

The HSC was designed to be simple and easy to use. The questions on the safety checklist were based on TJC Center for Transforming Health Care (2009) summary report, entitled "Validated Root Causes for Transition of Care: Hand-off Communications Failures" that identified communication barriers of 10 hospitals in the United States. A mnemonic checklist is one memory aid used as a nursing handoff tool cited in handoff communication literature reviews (Riesenberg et al., 2010). The HSC for this study was formatted as a mnemonic guide by using the word *SAFETY*. Each letter represented an essential patient or procedure information item at the handoff, beginning with the specific letter, such as S for specimen, A for allergy, F for fluids, E for equipment, T for tissue, and Y for yes nurses agree on handoff information. The checklist was printed on 8 1/2" x 11" paper, laminated, and placed near the nurse's wireless computer in the seven OR suites of the hospital. At the time of the permanent nurse circulator handoff during orthopedic or general surgery procedures, the off-going nurse used the laminated checklist as a guide to report necessary information to the on-coming nurse.

Pre- and Post-intervention Survey Instrument

TJC Center for Transforming Healthcare (2009) that summarized reports of the causes of handoff communication barriers and failures of 10 hospitals in the United States was used as a model to develop the pre-intervention, 4- and 8-week post-intervention questions on the survey. From the report, 19 out of 20 statements were selected and rephrased for the surveys to reflect the perioperative arena. The questions were categorized according to general, out-going nurse, and in-coming nurse, and were intended for the nurse based on his perception and professional practice of nurse-to-nurse handoff within the given role. Self-reporting methods do not accurately capture the practice of compliance; however, self-reporting surveys and questionnaires have been used in studies on safety checklist briefings (McDowell & McCombe, 2014). The statements were aimed at the study's objectives; therefore, they were concentrated on teamwork, collaboration, safety during handoffs, and quality of handoffs. A similar 19-point attitude questionnaire was also used at the University of Witten/Herdecke, Cologne, Germany, where the implementation of a perioperative checklist to determine the increase of patient safety and staff satisfaction was studied (Bohmer et al., 2012). In all appearances, the face and content validity of the questionnaire was appropriate.

A Likert-type numeric scale was used and response values were assigned accordingly: 1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly agree. The study at the University of Witten/Herdecke, Cologne, Germany also used the Likert scale to score an attitude questionnaire (Bohmer et al., 2012).

Data Collection and Analysis

Identical surveys were used for the pre-intervention, 4-week, and 8-week post-intervention surveys, and were labeled separately as group A for hospital OR nurses and group B

for ASU OR nurses for the purpose of anonymity. No participant and patient identifiers were used on the surveys. All three surveys were completed without the student researcher present, placed in a manila envelope for collection, and translated for data analysis via an Excel spreadsheet. Signed consents and collected data were retained by the student research for security.

Data were presented as mean and median values and quartiles range, as proportions of aggregated responses, and analyzed with a 2-sample *t*-test for mean values, and Pearson's chi-squared test and Fisher exact tests for proportions. P-value less than 0.05 is considered significant.

Results and Discussion

The study revealed significant findings and positive outcomes from the HSC innovation implemented. Statistical analysis of the results, if applicable, provided evidence of significance.

Results

Three surveys were conducted before and after the checklist was implemented. The 19-item questionnaire of the pre-intervention and 4- and 8-week post-intervention surveys were subdivided into three categories: generalized statements, out-going nurse, and in-coming OR nurse (see Table 1). The nurses were instructed to score all the statements in the role of an out-going and in-coming nurse circulator for each survey (see Appendices B, C, and D). The number of surveys submitted determined that the *t*-test and Chi Square tests were the appropriate statistical tools for data analysis.

From the possible 35 OR nurse volunteers from both the hospital and ASU, 15 hospital and 4 ASU ORNs completed the surveys (see Table 2). This table compares the number of results between groups A and B that resulted in the exclusion of group B for further comparisons. From the possible 35 ORN volunteers from both settings (hospital and ASU), 15 hospital and 4 ASU ORNs completed the surveys. Survey responses from group A had the most responses (16) at the 4-week, and the fewest responses (12) at the 8-week post-intervention. Survey responses from group B had the most responses (4) at pre-intervention and lowest responses (0) at the 8-week intervention. Moving forward, responses, results, and data illustrations are referenced to group A.

The responses of the pre-intervention and 4-week post-intervention surveys show slight significance, with a P value of $< .05$ of both the *t*-test results in statements S4, S12, S13, S19, and Fisher Exact test in statement S1 (see Table 3). The majority of the nurses' perceptions of

handoff quality and nurse satisfaction in comparison between the pre-intervention and 4-week post-intervention surveys illustrate very slight significance in the quality of improvement. The results can be due to the varied interpretation of the survey statements by individual nurses.

Interestingly, the significance illustrated at 4-week post intervention was not sustained into the 8-week post intervention (see Table 4). There was significance of the satisfaction of outgoing nurse handoff communication t-test = p value < 0.003.

The best method of describing categorical data is by frequency (see Table 5). The categories were divided into pre-intervention, 4-week and 8-week posts, and combined pre- and post-intervention. Frequencies of missing responses were 7 from pre-intervention survey and 21 responses of the combined 4- and 8-week post-intervention surveys. The first column on the left, labeled "Response," with rows labeled 1-5, represent the Likert scores. It is interpreted as the frequency of responses for each Likert score for pre-intervention and 4- and 8-week combined post-interventions. The limited number of responses from the survey determined the use of Pearson's chi-squared test as appropriate instead of another statistical test, such as the Analysis of Variance (ANOVA). Two non-parametric tests of Pearson's chi-squared and t-value were used and yielded significant results. The Pearson's chi-squared value of 57.0 is analogous with the t-Value of 5.83. There was significant improvement of quality in nurses' communication and nurses' satisfaction, $t = (df=4)5.83$, $p < .0001$, of aggregated responses of the pre-implementation, 4- and 8-week interventions.

Table 1

Survey Statements Subdivided

Stmt #	General statements for all nurses
S1	Our unit culture promotes successful handoff by teamwork and mutual respect of roles
S2	Expectations between outgoing and incoming nurse are the same
S3	Physical handoff is occurring at an opportune time during the procedure
S4	Enough time is allowed during hand-off
S5	Interruptions occur during handoff
S6	Disruptions occur during handoff
S7	I follow a standardized approach to every hand off for every patient every time
	Statements as an outgoing nurse
S8	I provide complete & accurate patient information and status of the procedure
S9	I provide complete & accurate information, such as medications, specimens, implants, and/or distractions
S10	I have no competing priorities, interruptions, or distractions
S11	I am fully engaged during the hand off
S12	I am satisfied with the quality of the hand-off
S13	I am satisfied my handoff communication contributes to a safe patient transfer
	Statements as an incoming nurse
S14	I receive complete & accurate patient information and status of the procedure
S15	I receive complete & accurate information, such as medications, specimens, implants or instruments
S16	I have no competing priorities, interruptions or distractions
S17	I am fully engaged during the hand off
S18	I am satisfied with the quality of the hand-off
S19	I am satisfied my handoff communication contributes to a safe patient transfer

Table 2

Summary of Group A and Group B Survey Respondents

Group	Grp A Pre	Grp A 4-Wk	Grp A 8-Wk	Grp B Pre	Grp B 4-Wk	Grp B 8-Wk
Number of respondents	14	16	12	4	2	0

Table 3

Comparison of Responses, Group A, Pre-implementation Versus 4-Week Post-implementation

Statements	Group A, pre-implementation Mean, Median (Q-Range)	4-week post-implementation Mean, Median (Q-Range)	T-test for means P-value	Fisher Exact test P-value
Group A: pre-implementation versus 4 week post-implementation				
General Statements for all Nurses Q1-Q7				
S1 Our unit culture promotes successful handoff by teamwork and mutual respect.	4.0, 4(4-5)	4.6, 5(4-5)	0.08	0.02
S2 Expectations between out-going and in-coming nurse are the same.	4.1, 4(4-5)	4.4, 5(4-5)	0.37	0.26
S3 Physical handoff is occurring at an opportune time during the procedure.	3.6, 4(3-4)	4.1, 4(4-5)	0.28	0.86
S4 Enough time is allowed during hand-off.	3.5, 4(3-4)	4.2, 4(4-5)	0.02	0.50
S5 Interruptions occur during handoff.	3.8, 4(4-4)	3.6, 4(3-4)	0.69	0.49
S6 Disruptions occur during handoff.	3.7, 4(4-4)	3.8, 4(3-5)	0.81	0.57
S7 I follow standardized approach to every hand off for every patient every time	4.1, 4(4-5)	4.5, 5(4-5)	0.10	0.33
Statements as an Out-Going Nurse S8-S13				
S8 I provide complete & accurate patient information and status of the procedure	4.2, 4(4-5)	4.6, 5(4-5)	0.06	0.15
S9 I provide complete & accurate information such as medications, specimens, implants	4.2, 4(4-5)	4.6, 5(4-5)	0.06	0.15

Statements	Group A, pre-implementation Mean, Median (Q-Range)	4-week post-implementation Mean, Median (Q-Range)	T-test for means P-value	Fisher Exact test P-value
S10 I have no competing priorities, interruptions, or distractions.	2.5, 2(2-3)	2.9, 3(2-4)	0.39	0.39
S11 I am fully engaged during the hand off.	4.2, 4(4-5)	4.4, 5(4-5)	0.38	0.85
S12 I am satisfied with the quality of the hand-off.	3.7, 4(3-4)	4.4, 5(4-5)	0.02	0.95
S13 I am satisfied my handoff communication contributes to a safe patient transfer	4.2, 4(4-4)	4.6, 5(4-5)	0.009	0.75
Statements as an In-Coming Nurse S14-S19				
S14 I receive complete & accurate patient information and status of the proc	3.4, 3(3-4)	4.0, 4(4-5)	0.10	0.86
S15 I receive complete & accurate information such as medications, specimens, implants	3.4, 4(3-4)	4.1, 4(4-5)	0.09	0.57
S16 I have no competing priorities, interruptions or distractions.	2.9, 2(2-4)	2.9, 3(2-4)	0.97	1.00
S17 I am fully engaged during the hand off.	4.4, 4(4-5)	4.4, 5(4-5)	0.70	0.45
S18 I am satisfied with the quality of the hand-off.	3.6, 4(3-4)	4.1, 4(4-5)	0.11	0.31
S19 I am satisfied my handoff communication contributes to a safe patient transfer	3.9, 4(4-4)	4.5, 5(4-5)	0.01	0.47

Table 4

Comparison of Group A, Pre-implementation Versus 8-Week Post-implementation

Statements	Group A, pre-implementation Mean value	8-week post-implementation Mean value	T-test for means P-value	Fisher Exact test P-value
Group A: Pre-Intervention vs 8 Week Post-Intervention				
General Statements for all Nurses S1-S7				
S1 Our unit culture promotes successful handoff by teamwork and mutual respect	4.0	4.1	0.84	0.48
S2 Expectations between out-going and in-coming nurse are the same.	4.1	4.3	0.81	0.28
S3 Physical handoff is occurring at an opportune time during the procedure.	3.6	4.1	0.26	0.60
S4 Enough time is allowed during hand-off.	3.5	4.0	0.15	0.31
S5 Interruptions occur during handoff.	3.8	3.9	0.77	0.13
S6 Disruptions occur during handoff.	3.7	3.6	0.81	0.61
S7 I follow standardized approach to every hand off for every patient every time	4.1	4.4	0.22	0.15
Statements as an Out-Going Nurse S8-S13				
S8 I provide complete & accurate patient information and status of the procedure	4.2	4.7	0.05	0.33
S9 I provide complete & accurate information such as medications, specimens, implants	4.2	4.7	0.05	0.33
S10 I have no competing priorities, interruptions, or distractions.	2.5	3.8	0.01	0.84
S11 I am fully engaged during the hand off.	4.2	4.5	0.40	0.34
S12 I am satisfied with the quality of the hand-off.	3.7	4.5	0.01	0.93

Statements	Group A, pre-implementation	8-week post-implementation	T-test for means	Fisher Exact test
	Mean value		P-value	P-value
S13 I am satisfied my handoff communication contributes to a safe patient transfer	4.2	4.7	0.003	0.05
Statements as an In-Coming Nurse S14-S19				
S14 I receive complete & accurate patient information and status of the proc	3.4	4.1	0.10	0.42
S15 I receive complete & accurate information such as medications, specimens, implants	3.4	4.1	0.11	0.37
S16 I have no competing priorities, interruptions or distractions.	2.9	3.7	0.09	0.89
S17 I am fully engaged during the hand off.	4.4	4.6	0.18	0.79
S18 I am satisfied with the quality of the hand-off.	3.6	4.0	0.18	0.05
S19 I am satisfied my handoff communication contributes to a safe patient transfer	3.9	4.4	0.17	0.18

Table 5

Group A Pre-intervention Versus Combined 4- and 8-Week Post-intervention

Frequencies, Proportions, and Pearson's chi-squared test

	Pre-implementation		4- and 8-week post-implementation		Combined	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Response						
missing	7	2.63	14	2.63	21	2.63
1	4	1.50	14	2.63	18	2.26
2	33	12.41	29	5.45	62	7.77
3	37	13.91	36	6.77	73	9.15
4	135	50.75	210	39.47	345	43.23
5	50	18.80	229	43.05	279	34.96

Chi-squared = 57.0 Chi-squared Prob <.0001

Mean values and t-test

Survey	Mean
Pre-intervention	3.75
4- & 8-week Post-intervention	4.18

t Value = 5.83 P-value <.0001

Discussion

The simple design of the checklist was purposeful for rapid adoption (see Appendix A). A HCS tool implemented in seven OR rooms at the selected hospital that was void of a nurse handoff checklist was necessary to determine if it could improve the quality of nursing communication and nursing satisfaction in the handoff process (Greenberg et al., 2007). Although designated as the control group, the ASU was omitted as a comparison group due to the scarcity of submitted surveys and data.

The 19-statement survey was conducted at three different time intervals, completed by OR nurses at both sites, and collected for data analysis (see Appendices B, C, and D). The times, situations, and environment in which the questions were answered varied with the nurse respondents, and thereby weakened the external validity of the questionnaire. The representation of the sample population of a study is essential to the reliability of a measurement tool (Polit & Beck, 2004). In this case, the survey was piloted by a single set of OR nurses in one type of setting. In addition, it lacked expert evaluation and comparison with an established gold reference or standard to be confident of the surveys' construct and relevance (Polit & Beck, 2004). Furthermore, the reliability of the survey was weakened by the absence of formal reviews, modifications, and test/retests (Polit & Beck, 2004). Rogers' DIT was used to implement the HSC, and Donabedian's structure, process, and outcome model was the framework of the quality component of the study.

The pre-intervention survey, as compared to both the 4-week and 8-week survey showed minimal significance. However, the results illustrate significance when all three surveys are combined. The interpretation in the HSC tool is valuable and effective when used during the patient handoff process in the OR.

Conclusion

The lack of a standardized nurse-to-nurse handoff communication in the OR results in poor patient outcomes and risks to patient safety and leads to poor communication and decreased nurse confidence of handoff communication. Thorough, accurate, and effective communication safeguards the surgical patient's safety. The use of a safety checklist is one method to communicate all essential patient information during the handoff process. The research studies and literature have concluded that inadequate and inaccurate communication prohibit effective nurse handoffs (Riesenberg et al., 2010). Evidence-based literature also recommended the implementation of a communication tool for thorough nurse handoffs (Riesenberg et al., 2010). The data analysis from the collected surveys illustrates statistical significance in the use of a HSC during the nurse-to-nurse handoffs. Hence, improved patient outcomes and patient safety can also improve the quality of nursing communication and confidence in the nurse-to-nurse handoff communication with sustained use of the checklist.

Success and Challenges

The HSC was temporarily implemented with the support of Rogers' DIT. The checklist was designed and conveyed to the OR nurses as simple and easy-to-use to encourage its adoption at the handoff process of the nursing workflow. In preparation for the actual implementation of the checklist, the concept of the innovation was socialized at staff meetings and huddles. The ORNs perceived the HSC as a new innovation when it was presented at the ASU and hospital OR staff meeting. By all appearances and from positive responses, the concept of a handoff checklist was received with enthusiasm and supported by the managerial team and nursing staff at both the hospital OR and ASU. However, support began to ebb 2 weeks after the checklist was implemented, and challenges surfaced.

The formal and informal nurse leaders of the OR voiced their support; however, the remaining nurses doubted the checklist's value to their handoff process and resisted the addition to their already impacted workflow. Although the nurses initially acknowledged safety benefit of the checklist, the slight change to their handoff process hindered their full acceptance of it. The enthusiasm initially observed gradually evaporated and use of the HSC was lost after 8 weeks. The unit's deeply rooted culture and its resistance to change away from the usual workflow impeded the nurses' acceptance and adoption of the HSC that benefits individual nursing practice and patient safety. The visible support from formal key leaders to endorse the benefits of the checklist to group A nurses was mildly discernible.

Donabedian's SPO model supported the quality component of the study. The study conducted in Queensland, Australia to measure the quality of nurse practitioner service successfully implemented Donabedian's theory (Gardner et al., 2013). The beginning improvement in the quality of nursing communication and satisfaction in the handoff process was illustrated by statistical significance, p-value < 0.001 of the pre- and post-intervention surveys results.

Limitations

Multiple limitations were identified in the study, the primary one being the single hospital OR site and the small pool of volunteer nurse participants it provided. Larger numbers of participants from multiple hospital sites may have provided substantial data and stronger analysis. A larger sample size may have also extracted a statistical power analysis. The use of a control group may not have been warranted. A substantial instruction on the use of the checklist and broader explanation of the survey statements may have revealed different findings in the resulting data. Heightened visibility and verbal support from key leaders was essential to

encourage continued staff enthusiasm and positive attitude toward its worth for patient safety. The validity and reliability of the HSC and the surveys were not tested through repeated trials.

Implications for OR Nursing Practice

A simple and effortless HSC in a busy OR environment is a valuable tool for safeguarding the surgical patient. The recall of memory during handoff communication is unsafe and places the patient at risk. The significant findings of the study illustrate the patient safety value of a standardized checklist to ensure concise, accurate, and thorough nurse-to-nurse handoff communication. To further underscore the study's value, a standardized HSC contributes to positive patient outcomes and enhances patient safety while improving nurse handoff communication and increasing nurse confidence and satisfaction of the handoff process.

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APPENDIX A: HAND OFF SAFETY CHECKLIST

HAND OFF *SAFETY* CHECKLIST – RN CIRCULATOR

- Surgery patient and procedure, and surgery update.
- Surgical Counts – Sponge, Sharps, Instruments, Miscellaneous items.
- Specimens – Reconciliation of specimens & cultures (On & Off field)

- Anesthesia Type
- Allergies including patient medical history

- Fluids administered - IV, irrigation, medication, blood
- Family updates

- Equipment or instruments used borrowed or loaned

- Tissue Allograft / Implants

- Yes – We agree the intra-op log is updated & handoff is complete.

APPENDIX B: GROUP A – PRE-INTERVENTION

CHECKLIST SURVEY

GROUP A

Intra-Operative Nurse Handoff Communication
Pre Intervention Checklist Survey

Instructions: Please answer each question with a score from 1 strongly disagree to 5 strongly agree.

#	Questions	1 Strongly Disagree	2 Dis-agree	3 Un-decided	4 Agree	5 Strongly Agree
1	Our unit culture promotes successful handoff by teamwork and mutual respect of roles.					
2	Expectations between outgoing and incoming nurse are the same.					
3	Physical handoff is occurring at an opportune time during the procedure.					
4	Enough time is allowed during hand off.					
5	Interruptions occur during handoff.					
6	Disruptions occur during handoff.					
7	I follow a standardized approach to every hand off for every patient every time.					
	As the Outgoing Nurse					
8	I provide complete & accurate patient information and status of the procedure.					
9	I provide complete & accurate information, such as medications, specimens, implants, and/or instruments.					
10	I have no competing priorities, interruptions, or distractions.					
11	I am fully engaged during the hand off.					
12	I am satisfied with the quality of the handoff.					
13	I am satisfied my handoff communication contributes to a safe patient transfer.					
	As the Incoming Nurse					
14	I receive complete & accurate patient information and status of the procedure.					
15	I receive complete & accurate information, such as medications, specimens, implants, or instruments.					
16	I have no competing priorities, interruptions, or distractions.					
17	I am fully engaged during the handoff.					
18	I am satisfied with the quality of the handoff.					
19	I am satisfied my handoff communication contributes to a safe patient transfer					

APPENDIX C: GROUP A – 4-WEEK POST-INTERVENTION

CHECKLIST SURVEY

GROUP A

Intra-Operative Nurse Handoff Communication
4 Week Post Intervention Checklist Survey

Instructions: Please answer each question with a score from 1 strongly disagree to 5 strongly agree.

#	Questions	1 Strongly Disagree	2 Dis-agree	3 Un-decided	4 Agree	5 Strongly Agree
1	Our unit culture promotes successful handoff by teamwork and mutual respect of roles.					
2	Expectations between outgoing and incoming nurse are the same.					
3	Physical handoff is occurring at an opportune time during the procedure.					
4	Enough time is allowed during hand off.					
5	Interruptions occur during handoff.					
6	Disruptions occur during handoff.					
7	I follow a standardized approach to every hand off for every patient every time.					
	As the Outgoing Nurse					
8	I provide complete & accurate patient information and status of the procedure.					
9	I provide complete & accurate information, such as medications, specimens, implants, and/or instruments.					
10	I have no competing priorities, interruptions, or distractions.					
11	I am fully engaged during the hand off.					
12	I am satisfied with the quality of the handoff.					
13	I am satisfied my handoff communication contributes to a safe patient transfer.					
	As the Incoming Nurse					
14	I receive complete & accurate patient information and status of the procedure.					
15	I receive complete & accurate information, such as medications, specimens, implants, or instruments.					
16	I have no competing priorities, interruptions, or distractions.					
17	I am fully engaged during the handoff.					
18	I am satisfied with the quality of the handoff.					
19	I am satisfied my handoff communication contributes to a safe patient transfer					

APPENDIX D: GROUP A – 8-WEEK POST-INTERVENTION

CHECKLIST SURVEY

Intra-Operative Nurse Handoff Communication

GROUP A 8 Week Post Intervention Checklist Survey

Instructions: Please answer each question with a score from 1 strongly disagree to 5 strongly agree.

#	Questions	1 Strongly Disagree	2 Disagree	3 Un-decided	4 Agree	5 Strongly Agree
1	Our unit culture promotes successful handoff by teamwork and mutual respect of roles.					
2	Expectations between outgoing and incoming nurse are the same.					
3	Physical handoff is occurring at an opportune time during the procedure.					
4	Enough time is allowed during hand off.					
5	Interruptions occur during handoff.					
6	Disruptions occur during handoff.					
7	I follow a standardized approach to every hand off for every patient every time.					
	As the Outgoing Nurse					
8	I provide complete & accurate patient information and status of the procedure.					
9	I provide complete & accurate information, such as medications, specimens, implants, and/or instruments.					
10	I have no competing priorities, interruptions, or distractions.					
11	I am fully engaged during the hand off.					
12	I am satisfied with the quality of the handoff.					
13	I am satisfied my handoff communication contributes to a safe patient transfer.					
	As the Incoming Nurse					
14	I receive complete & accurate patient information and status of the procedure.					
15	I receive complete & accurate information, such as medications, specimens, implants, or instruments.					
16	I have no competing priorities, interruptions, or distractions.					
17	I am fully engaged during the handoff.					
18	I am satisfied with the quality of the handoff.					
19	I am satisfied my handoff communication contributes to a safe patient transfer					