6-2024

Safety Project to Prevent Unintentional Retained Surgical Items

Sherri Bobo
slb20a@acu.edu

This doctoral project, directed and approved by the candidate's committee, has been accepted by the College of Graduate and Professional Studies of Abilene Christian University in partial fulfillment of the requirements for the degree

Doctor of Nursing Practice

Nannette W. Glenn, Ph.D.
Nannette W. Glenn, Ph.D. (Jun 18, 2024 10:09 CDT)

Dr. Nannette Glenn, Dean of the College of Graduate and Professional Studies

Date: Jun 18, 2024

Project Team:

Dr. Sandra Cleveland
Dr. Sandra Cleveland (Jun 17, 2024 18:17 EDT)

Dr. Sandra Cleveland, Chair

Molly Kuhle (Jun 17, 2024 17:25 CDT)

Dr. Molly Kuhle

Abilene Christian University

School of Nursing

Safety Project to Prevent Unintentional Retained Surgical Items

A dissertation submitted in partial satisfaction

of the requirements for the degree of

Doctor of Nursing Practice

by

Sherri L. Bobo

August 2024

Dedication

I dedicate this body of work to my Father in Heaven, who has covered me under His protective wing, held me in the warmth of His loving arms, given me comfort when I felt discouraged and tired, and blessed me at times when health issues were concerning. Abba Father, I want to express my deepest gratitude and love for instilling in me fearlessness, tenacity, determination, and endurance to complete this dissertation. You have gifted me with knowledge, discernment, persistence, and sagacity, showing me that your love is unequivocal and complete.

To my devoted husband and best friend Joey, who has been my strongest supporter, the best listener, unwavering confidant, and has encouraged me every step of the way. You have sacrificed activities we always did together and suddenly could not because I had reading or school assignments to complete. You have kept our household calm and serene. Your love, patience, and tolerance have helped me to keep moving forward. I am blessed to have you in my life to unconditionally love me and praise me for my special accomplishments. I love you for the remarkable, wonderful Christian man you are, and I look forward enthusiastically as I anticipate the incredible trips we will soon be taking.

To my very amazing children, grandchildren, great-granddaughter, and close friends; thank you all for your encouraging and congratulatory words each time I completed a class. It was difficult not spending as much time together as in the past (before the DNP program). Now, that will change! I love all of you, and my appreciation for your love, confidence, support, and prayers during this journey is truly heartfelt. You are the BEST family ever!

To my precious Mama and Daddy and my mother-in-law and father-in-law, who are all in Heaven, I know they are proud of my educational achievements.

Acknowledgments

I want to express my warmest thanks and appreciation to the faculty and other individuals at ACU who contributed to this body of work and helped me to make it to the home stretch. Your guidance, support, encouragement, and kindness have been greatly appreciated. I am truly indebted to Dr. Sandra Cleveland for her selflessness and servant's heart, as she was gracious enough to become my committee chair at the very end of my journey. She had faith that I could complete this manuscript and successfully defend my project. Dr. Molly Kuhle has stayed with me from the onset as my committee member, and I sincerely thank her for her steadfastness and dedication. May God bless and keep you both.

I would like to express sincere gratitude to Dr. Catherine Garner (DrG) for her contributions to my scholarly project as my chair during the first year. She was instrumental in helping me to start the process, write Chapters 1–3, and make suggestions for effective theoretical frameworks of adult learning and evaluation of the project. Subsequently, I became ill with COVID-19 in December 2021 (that evolved into long COVID), and I was unable to work on the project or take classes for a substantial period of time. Consequently, DrG had to chair other DNP students. I am appreciative to Dr. Julie Lane for arranging for Dr. Cleveland to be my new chair. Dr. Lane was essential in assisting me in reaching this point, and I am extremely grateful to her that I have reached the end. She is an extraordinary project manager and a lovely person.

This has truly been an inspirational journey that I will always treasure. Achieving what was only a dream has made me realize that we have to chase our dreams no matter what. Earning the Doctor of Nursing Practice degree will be one of my greatest accomplishments as a nursing

professional (now in my 48th year). I continue to be passionate about nursing and hope to have a positive influence on young nurses in years to come.

Abstract

Fifty million surgeries are performed annually in the United States with an estimated 5,000 patients affected by unintentionally retained surgical items (RSIs) due to errors in the operating room. Surgical items inadvertently left inside patients may include sponges, instruments, needles, or small miscellaneous parts. It is not well understood why the surgical counting process fails to prevent the incidence of unintentional RSIs. The proposed educational curriculum was intended to enhance the knowledge and self-efficacy of surgical nurses and technicians to minimize errors and eliminate RSIs. Evidence-based strategies to complement existing knowledge of unintentional RSIs were introduced through didactic and visual imagery. A standardized instrument developed by the Association of periOperative Registered Nurses to prevent RSIs in the operating room OR was adapted to measure distinct variables of project participants. Patient injuries that can result from a retained surgical item include pain, infection, inflammatory fever, abscesses, permanent scarring, septic shock, bowel injuries, deformation and disfigurement, permanent disability, loss of sensation, stroke, brain damage, and death. Annual healthcare costs associated with unintentional RSIs are $2.4 billion in the United States. Despite policy and procedure mandates by healthcare organizations, regulatory efforts, and sanctions established by state and federal governments, surgical patients continue to have retained surgical items unintentionally left in their bodies during surgery. Stakes are high as morbidity and mortality are the ultimate costs.

Keywords: retained surgical item, RSI, preventable surgical error, communication in operating room, gossypiboma, unintended retention of foreign object, radiofrequency technologies

Table of Contents

Acknowledgments ii

Abstract v

List of Tables ix

List of Figures x

Chapter 1: Introduction 1

- Background of Population of Interest 2
- Affected Population 4
  - Ethical Characteristics 4
  - Economic Characteristics 5
  - Cultural Characteristics 5
- Purpose Statement and Evidence-Based Significance 6
- Purpose of Project 6
- Significance of Population of Interest 7
- Nature of Project 8
- PICO and Research Question 8
- Hypotheses 9
- Conceptual Framework 9
- Operational Definitions 11
- Scope and Limitations 12
- Chapter Summary 12

Chapter 2: Review of Literature 14

- Search Strategy 14
- Literature Review 15
  - Retained Items When Surgical Counts Are Correct 15
  - Retrospective Study of Retained Foreign Bodies Over 3-Year Period 16
  - Observational Study Centered on Surgical Safety Checklist 17
  - Systematic Review: Ineffective Communication Recurring Theme 18
  - Retained Surgical Items in Spinal Surgeries 20
- Conceptual Framework: Adult Learning Theory 23
- Conceptual Framework for Education Program 24
- Evaluation Framework 25
- Chapter Summary 26

Chapter 3: Research Methods 28

- Purpose 28
- Project Design 29
- Preliminary Components of Educational Training Module 30

Planning Strategies....31
Evaluation....31
Methodology Appropriateness....31
Instruments....32
Data Collection, Management, and Analysis Plan....33
Feasibility....33
IRB Approval and Process....34
Interprofessional Collaboration....34
Practice Setting....35
Target Population....35
Timeline....35
Risks....36
Benefits....36
Chapter Summary....37

Chapter 4: Results....38

Data Analysis Procedures....38
Interpretation of Paired Samples t-Test Output....39
Formula for Paired-Samples tTest (Pallant, 2020)....40
Purpose of Project....40
Demographics....41
Data Collection....42
Data Analysis....43
The Kirkpatrick Evaluation Model....43
Question Guiding the Inquiry....45
Hypotheses....45
Limitations of Project....45
Chapter Summary....46

Chapter 5: Discussion, Conclusions, and Recommendations....49

Implications of Analysis for Leaders....50
Recommendations for Future Research....51
Interpretation and Inference of the Findings....53
Essentials of Doctoral Education for Advanced Practice Nurses....53
Essential I: Scientific Underpinnings for Practice....53
Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking....54
Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice....54
Essential IV: Information Systems and Technology and Patient Care Technology for the Improvement and Transformation of Health Care....55
Essential V: Health Care Policy for Advocacy in Health Care....56
Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes....56

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health 57
Essential VIII: Advanced Nursing Practice 57
Conclusion 58
References 60

Appendix A: Kirkpatrick Four-Stage Model 69

Appendix B: Intervention—Educational Program 70

Appendix C: Permission Letter From AORN 77

Appendix D: Pretest Survey Questionnaire 78

Appendix E: Posttest Survey Questionnaire 83

List of Tables

Table 1. Results of Two-Tailed Paired-Samples *t* Test for the Difference Between Dependent Variable 1 Pretest and Dependent Variable 2 Posttest 40

List of Figures

Figure 1. Adult Learning Theory: Andragogy 10

Chapter 1: Introduction

Operating room (OR) environments command reliable and methodical processes anchored by sustainable safeguards to ensure patient safety. OR processes should be consistent, systematic, and understood by the entire OR team, from novice to expert. Surgical team participants are expected to uniformly conduct their duties with mutual moral integrity, ethical competence, and legal accountability in mind to support optimal outcomes for their surgical patients (Gibbs, 2011). “Never events” are serious, preventable events that continue to occur despite collaborative efforts to improve surgical patient safety. The National Quality Forum (NQF) has described one such problem in the operating room as a retained surgical item (RSI), characterized as a surgical supply or instrument unintentionally retained within patients after surgical or invasive procedures (as cited in Wallace, 2017).

The Joint Commission classifies RSI events as sentinel events and the most frequently reported in the U.S. healthcare system (as cited in Flanagan, 2019). The Joint Commission (TJC) disclosed in March 2018 that of the 805 sentinel events reported from the 2016–2017 calendar years, 116 cases involved surgical item retention (as cited in Knowles, 2018). Fifty million surgeries are performed annually in the United States (Santos & Jones, 2023), with an estimated 5,000 patients affected by RSIs (Kertesz et al., 2020).

Guidelines based on national standards of care have defined effective surgical count protocols. Counting practices may frequently be adopted by healthcare organizations to accommodate the OR teams’ own system of managing count processes rather than by standardized procedures. Varying practices for counting throughout OR environments increase the risks associated with retained surgical objects (RSOs). Gibbs (2011) reported that the preferred term is RSIs, classifying surgical items into four groups: “sponges, needles,

instruments, and miscellaneous small objects" that can inadvertently be left in the patient (Gibbs, 2011, p. 1536).

Leaving items in patients after surgery are unnecessary errors that should be challenged with a standardized approach to prevention and focus on patient safety. In OR environments, defective processes of care or ineffective communication among surgical team personnel can result in RSI events (Landers, 2015). Patterns of inferior processes include incomplete or insufficient exploration of the wound prior to cavity closure, inaccurately performed counts, and omission of preclosure radiography during surgery (Gibbs, 2011). As a result, radiopaque items should be used exclusively by surgeons, and a methodical examination of the wound should be performed prior to closure in every surgical case. Gibbs et al. (2007) concluded that it is important that surgeons strive to "see and touch" when possible during wound exploration.

Background of Population of Interest

The surgical counting practice, commonly referred to as "the count," is a fundamental practice in the OR and the most widely used screening method (Steelman et al., 2018). Its primary purpose is to scrutinize count discrepancies to ensure that items such as instruments, surgical sponges, sharps, and towels are not left in the patient's surgical wound (Cima et al., 2008). It was noted in an article by Fencl (2016) in the Association of periOperative Registered Nurses (AORN) Journal that the medical, physical, and emotional effects of avoidable patient errors are immeasurable. Patient injuries that can result from RSIs include pain, infection, inflammatory fever, abscesses, permanent scarring, septic shock, bowel injuries, deformation and disfigurement, permanent disability, loss of sensation, stroke, brain damage, and death (Flanagan, 2019; Zarenezhad et al., 2017).

Surgical counting has surprisingly remained substandard in many organizations and unaided by technological support (Steelman et al., 2018). Instead, counting relies exclusively on the discipline and training of the circulating nurse. The way counts are conducted in the OR should be continually analyzed and adjustments made to the processes as needed to minimize the risk of RSIs (Cima et al., 2008). Steelman et al. (2018) reported that radiography could determine if a retained item is present. Nurse circulators are responsible for managing the safety of patients in the OR, and the surgical count is a vital activity that contributes to that safety. Gibbs (2011) determined that incomplete and inaccurate transmission of relevant information between intraoperative personnel and defective processes of care are the primary causes of retained items.

Emphasis must be on a multidisciplinary approach, establishing that all OR team members are responsible for the prevention of RSIs by completing proper "accounting" procedures (Gibbs, 2011). Any surgical item left in a patient can lead to complications with the patient's recovery. Verna Gibbs, director of NoThing Left Behind®, stated in guideline updates by the AORN that impaired communications may include surgeons dismissing miscounts as erroneous or multiple surgical team personnel changes without methodical cross-informational reporting (Association of periOperative Registered Nurses [AORN], 2016). Inconsistent application of known safety factors, such as closing wounds with the reconciliation count incomplete or secondary personnel in the OR creating distractions or confusion, is highly discouraged. Counting is predisposed to errors as human efficiency and preciseness can be unreliable in ORs where pressures of time, distractions, and unexpected interruptions are typical deterrents. Anyone can make errors at any time (Gawande et al., 2003).

Affected Population

Anesthetized patients undergoing surgery or invasive procedures may be potentially at risk for unintentional RSIs. Ethical, economic, and cultural characteristics are social determinants that impact patients' medical or surgical treatment, while healthcare professionals support and encourage positive outcomes.

Ethical Characteristics

Ethics are regarded principally as a proscriptive process in a given situation, suggesting the actions one should take and providing affirmation that the appropriate action has been taken. This moral reaction should encourage the nurse in the OR to vigorously and compassionately provide competent care for the surgical patient (Gunnar et al., 2020). OR personnel should frequently examine the tenets of surgical care to establish risk factors that may contribute to the vulnerability of patients to surgical errors, such as RSI. Ethics are a social value that influences healthcare professionals to identify principles to broaden emerging circumstances while prioritizing patients' health. Patients taken to the OR are vulnerable and, consequentially, at the mercy of the surgical team and its collective ingenuity and competence (Gunnar et al., 2020).

The surgeon, circulating nurse, surgical tech, and anesthesiologist desire to act ethically in how they care for their patients. This includes being respectful to patients, demonstrating exemplary role modeling, incorporating critical decisions with a code of conduct and one's belief system, and prominent reliance on personal morality (Gunnar et al., 2020). Therefore, ethical determinations should always be reverential of patient wishes, values, and perspectives.

Obtaining informed consent for a defined surgery or procedure is a critical component of clinical standards for surgical care and is an ethical practice (Ziman et al., 2018). Patients are vulnerable when taken into the OR as they are rendered helpless. Once under anesthesia, they

can no longer speak for themselves; thus, the circulating nurse acts as their advocate. Pediatric patients are especially susceptible to harm. As a result, a strong sense of trust must exist with patients and their families (Gunnar et al., 2020).

Economic Characteristics

Significant costs are connected to unintentional RSIs. According to Goodwin (2018), the Centers for Medicare and Medicaid Services (CMS) have adopted regulations declaring that costs associated with RSIs will not be reimbursed. As a result, institutions must absorb the costs of RSI-related surgery and the associated hospitalization.

When there is a discrepancy, personnel must reconcile counts resulting in expenses due to extended OR time (charged incrementally). These costs may or may not be passed on to the patient (Goodwin, 2018).

RSIs can induce substantial patient harm, including "pain, inflammatory fever, sepsis, abscess, and bowel complications" as clinical consequences (Zarenezhad et al., 2017, p. 24). This surgical error can result in considerable liability risk. Significant litigation costs may be brought forth for the institution based on alleged malpractice and a civil lawsuit filed against the surgeon. Legal affiliations recognize "the system" is culpable as opposed to an individual, thus finding that RSIs are a result of a sequence of human and team factors (Styskel et al., 2016).

Cultural Characteristics

Cultural competence in surgical care is imperative, as ethnic diversity has increased in our society in recent years. Interactions with patients of all cultures, languages, and backgrounds bring to the forefront behaviors and health beliefs influenced by their cultures. Distinct identities of immigrant populations create both opportunities and challenges for healthcare providers as they navigate varying perspectives, beliefs, and cultural traditions that actuate health and well-

being decisions. For example, surgical patients may not be willing to have blood transfusions administered if indicated due to their religious beliefs (Davoodvand et al., 2016).

Communication barriers may contribute to confusion and biases and affect health outcomes. Obtaining informed consent hinges on effective patient–surgeon communication and providing explanations of procedural risks and potential outcomes. Cultural sensitivity and social justice help to ensure ethnic minority patients are treated with dignity, respect, and in a professional manner. According to Davoodvand et al. (2016), advocacy for patients includes two key elements: protecting the patient from harm and empathetic patient-centered care.

Purpose Statement and Evidence-Based Significance

The purpose of this surgical safety project was to develop an educational program for OR teams based on the best evidence from relevant literature, interprofessional collaboration, and leadership support. Retained surgical item events are perplexing and continue to occur. Reliable evidence suggests that variability in counting practices contributes to these errors (Gibbs, 2012).

Purpose of Project

While the AORN has developed a standardized training program for novice OR nurses, it was inadequate in its early development to address unique areas, such as the prevention of RSIs in the operative setting. This study addressed the gap in clinical practice education with the development and delivery of a standardized training module to specifically target practices that reduce the risk of RSIs and included counting and imaging protocols in the OR. Evidence-based practice (EBP) was systematically applied through the reexamination of relative policies and procedures and the cultivation of changes to current practice. This evidence was synthesized into a continuing education program, which included both didactic and visual imagery. This program

was designed to enhance the knowledge and self-efficacy of OR nurses and surgical techs regarding the importance of preventing RSIs.

Significance of Population of Interest

Surgical counting has become an automated routine that may result in team members becoming overconfident and neglecting attention to detail. Distractions abound in the surgical environment from ringing phones, pagers beeping, loud music, team members talking incessantly, and the circulator retrieving supplementary supplies (Flanagan, 2019). Unreconciled counts prior to wound closure may result when the surgeon approves an erroneous count without reexamining the surgical wound or the staff accepts an inaccurate count (Gibbs, 2011). The performance of each surgical count check mandates the undivided attention of the OR team, and consequently, behaviors that hinder that process are unacceptable (Gibbs, 2011).

Surgeons routinely rely on the circulating nurse's knowledge, but their specific routines are often unknown. Most of the responsibility for preventing retained sponges resides with the nurse's ability "to count." Count discrepancies often occur when the surgical technician (ST) or circulating nurse misplaces items in the OR, either on the back table or surgical field. However, surgical sponges can be left in the patient when as few as 10 sponges are used in the case (Gibbs, 2012). Ineffective team communication may ensue for any number of reasons in the high-stakes surgical environment and create chaos, hindering team members from working collaboratively. It is essential that surgeons and staff work together to rectify incorrect counts, surgeons approve requested searches for missing items, staff effectually conduct counts, and correctly report between counts or to relief staff (AORN, 2016).

Nature of Project

The objective of this patient safety initiative was the development and delivery of an educational intervention to ensure the prevalence of RSIs is *zero* by refining policies and developing more effective processes of care to keep patients safe (Cima et al., 2008). In the development of a high-reliability course for the operating room, proposed actions included (a) standardized counting protocol for all sponges, sharps, instruments, and other surgical tools that can be retained, (b) enhancing the culture of the surgical microsystem, and (c) gaining additional understanding of the human-factors approach in diminishing the frequency of retained items.

The organization's patient safety opportunity was to develop and implement a reliable process that could withstand change of shifts, momentary diversions, complexity of procedures, hostile behaviors, team turnovers for lunch and breaks, and minimization of reliance on memory.

PICO and Research Question

Population of interest. The multidisciplinary operating room team (registered nurse [RN] circulators and STs) in a hospital-based perioperative department.

Intervention. Educational intervention for team training to correct defective counting practices and ineffective communication in the OR, thereby reducing the risk of unintentionally retained surgical items.

Comparison. Evaluation of knowledge and self-efficacy of nurses and STs before and after RSI education and training.

Outcome. Successful implementation and sustainability of an educational program designed to enhance the knowledge and self-efficacy of OR nurses and STs.

Research Question: Does an evidence-based educational program improve the knowledge and self-efficacy of OR nurses and STs in the prevention of RSIs?

Hypotheses

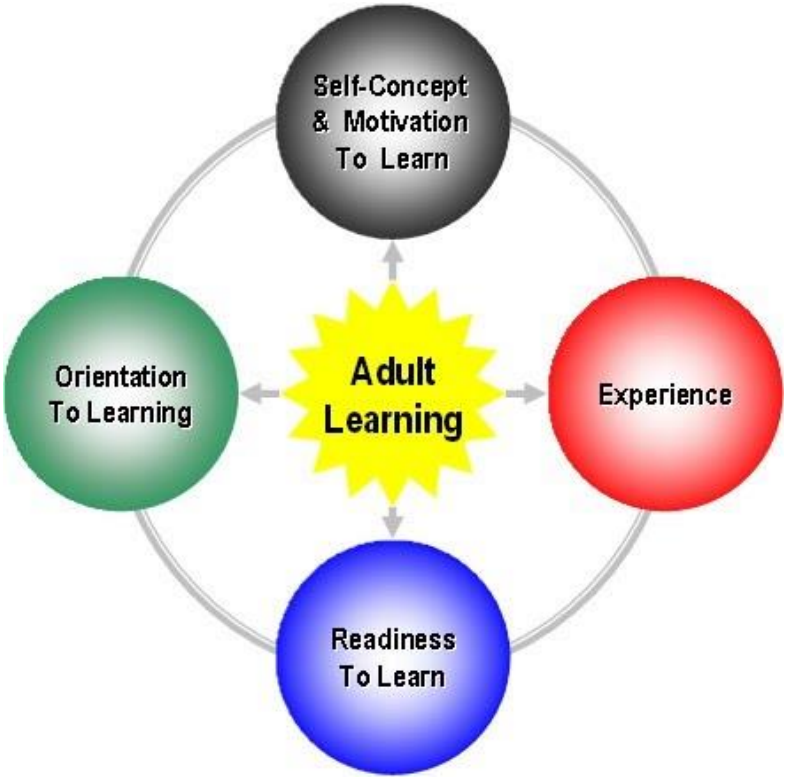
- Hypothesis 1: The education program improved the knowledge of OR nurses in the prevention of RSIs.
- Null Hypothesis 1: The education program did not improve the knowledge of OR nurses in the prevention of RSIs.
- Hypothesis 2: The education program improved the self-efficacy of OR nurses in the prevention of RSIs.
- Null Hypothesis 2: The education program did not improve the self-efficacy of OR nurses in the prevention of RSIs.

Conceptual Framework

Malcolm Knowles is credited for revitalizing the adult learning theory and application of its scientific name of *andragogy* (Kurt, 2020; see Figure 1). Knowles' focus was on adult education in the United States and the science behind it, continuously exploring methods and processes for designing collaborative curricula (Kurt, 2020). Knowles reestablished the concept of andragogy in 1968, interpreting the theory as "the art and science of helping adults learn" and introduced it as learner-focused education (Bouchrika, 2024, p. 1). The term derives from the Greek *andr-* and -a*gogy*, literally translated as *leading men* (Bouchrika, 2024).

Figure 1

Adult Learning Theory: Andragogy



Note. From *The Andragogy Approach: Knowles' Adult Learning Theory Principles in 2024*, by I. Bouchrika, 2024 (https://research.com/education/the-andragogy-approach). In the public domain.

The training evaluation framework was based on Kirkpatrick's four-stage model of the evaluation of continuing education effectiveness and depicted as four guiding principles (Andreev, 2023). The techniques of evaluation provided the tools to adequately gauge learning in the contexts of reaction, learning, behavior, and results. For the purpose of this project, only the first two levels were measured, and the remaining two levels of behavior and results were to be implemented by the host facility after the conclusion of the project.

Operational Definitions

Closing count. A count conducted at the completion of the procedure but before the surgeon has completely closed the incision (Greenberg et al., 2008).

Devices. Catheters, drains, and guidewires are devices used in surgery (Wallace, 2017).

Discrepancy. Any instance during a surgical case in which the subsequent count is different from the previous one (Greenberg et al., 2008).

Gossypiboma. A surgical sponge inadvertently left inside a patient during a surgical or invasive procedure (AORN, 2016).

Initial count. Count that occurs before the procedure begins (Greenberg et al., 2008).

Instruments. In this study, whole surgical instruments such as scissors, forceps, and retractors (Wallace, 2017).

Interim counts. Counts conducted throughout the case per OR protocol and at the discretion of the surgical team, such as handoffs for lunch relief or shift change (Greenberg et al., 2008).

Miscellaneous items. In this study, intact items, including drill bits, screws, vessel loops, nails, cautery tips, and wing nuts (Wallace, 2017).

Miscount. Discrepancy occurs in error when sponges, sharps, needles, or instruments do not correlate to the actual number of items present, such as undercount or double count (Greenberg et al., 2008).

Misplaced item. Item that is unintentionally lost and may be inside the patient, in the drapes, in the trash, or on the floor and may or may not be subsequently located (Greenberg et al., 2008).

OR nurse (aka nurse circulator). An RN who provides care according to the nursing process for patients undergoing surgery or invasive procedures. They have the relevant knowledge and skills to support positive patient outcomes (AORN, 2019).

Reconciliation count. Count occurs after the incision is closed and all sponges have been removed from the sterile field. Sponges previously removed from the field have been counted and placed in plastic bags with 10 sponges in each bag per standard protocol (Greenberg et al., 2008).

Sharps. In this study, suture needles, scalpel blades, and hypodermic needles; any item with points or edges that may puncture or cut (Wallace, 2017).

Surgical technician (ST). An allied health professional, also known as a scrub or operating room technician (ORT), who works under the supervision of the surgeon, fulfilling the role of the primary scrub. This tech prepares the OR for surgery, sets up sterile field and surgical instruments, drapes the patient, gowns, and gloves the surgeon (AORN, 2016).

Scope and Limitations

The scope of this patient safety project was limited to the development of an educational intervention for OR teams at one community hospital to prevent unintentional RSIs. The program provided RSI education and coordinated training for RNs and STs. Its content was based on evidence-based strategies to standardize counting practices, hard-wire processes, modify policies as needed, and create a culture of transparency and reliability.

Chapter Summary

Despite policy and procedure mandates by healthcare organizations, regulatory efforts, and sanctions established by state and federal governments, surgical patients continue to have RSIs unintentionally left in their bodies during surgery. Stakes are high as morbidity and

mortality are the ultimate costs. Interventions thus far are simply not working, and the call to action is for the perioperative community to establish effective, systematic, and reliable processes for performing surgical counts in the OR. The next chapter will introduce the literature review and identify the theoretical framework.

Chapter 2: Review of Literature

Search Strategy

This chapter was based on an extensive literature search conducted in databases that included the Cumulative Index of Nursing and Allied Health Literature (CINAHL), MEDLINE, and Health Source: Nursing/Academic Edition. The keywords and phrases central to the search strategy utilizing Boolean operators included *retained surgical items* or *RSI* or *retained foreign bodies* or *RFB* or *retained instruments* AND *gossypiboma* or *surgical counts* or *miscounts* retrieved a total of 520 citations with specific results yielding 343 in CINAHL, 82 in MEDLINE, and 95 in Health Source: Nursing/Academic Edition. A subsequent search was performed with keywords and phrases: *retained surgical items* or *RSI* or *retained foreign bodies* or *RFB* or *retained instruments* AND *communication in the operating room* or *team communication* AND *preventable surgical error* or *surgical counts* or *miscounts*. Inclusion criteria were restricted to English-language, peer-reviewed, and scholarly articles published between the years 2015–2020, excluding classic works that provided historical perspectives related to the topic. This search for peer-reviewed articles initially only generated a total of 229 citations, with 173 from CINAHL Complete, 50 from Health Source: Nursing/Academic Edition, and six from MEDLINE. The preliminary search yielded 37 relevant articles, which narrowed the scope of the problem. The search objective was to retrieve peer-reviewed research articles that generated evidence-based solutions, practical implications, and effective information sharing in the OR. This literature review included research studies in the United States and internationally. Only research articles relevant to the problem were reviewed.

Literature Review

Retained Items When Surgical Counts Are Correct

Unintentional retained surgical sponges (RSSs) can result in patient harm "involving reoperation, readmission/prolonged hospitalization, infection or sepsis, fistulas/bowel obstructions, visceral perforation, and death" (Steelman et al., 2018, p. 1). Steelman et al. (2018) reviewed retrospective reports from TJC sentinel event database of unintentional RSS from 2012–2017. The purpose of this descriptive study was to identify the kinds of sponges, the anatomy of retained sponges, the surgical specialty, specifics of the associated sponge counts, factors that may have contributed to the event, and any reported harm or consequences for patients. The sentinel events retrieved included patients who had undergone a surgical or invasive procedure or had given birth (Steelman et al., 2018). In 21 different studies in this systematic review, gossypibomas (surgical sponges) were the most frequently reported RSIs (Hempel et al., 2015). Additionally, counting protocols were in place for half of the reported incidents.

A sponge count was conducted in 77.4% of reported cases; counts were described as "correct" in 80.6% of the reported incidents, according to Steelman et al. (2018). However, counts were not performed in emergent cases, such as trauma. Human factors, leadership, and communication contributed to most incidents. Severe transitory harm was reported in 14.7% of the 319 patients and one death, one case of permanent harm, and two patients with permanent loss of function were documented (Steelman et al., 2018).

Steelman et al. (2018) suggested including an evaluation of existing and emerging technologies to complement the critical task of counting and recommended utilizing traditional counts and technology together as their best strategy. This is important because it can be taxing

for the circulating nurse to factor in the intangibles that happen simultaneously in the OR, increasing the risk of unintentional RSI. As a result, it is essential that organizations outline consistent, reliable, and efficient processes for performing counts to prevent RSIs (Kertesz et al., 2020).

The extensive dataset obtained by Steelman et al. (2018) provided a broad view of more precise knowledge related to contributing factors of RSS, including poor communication and inattentiveness of OR staff. Selection bias may have resulted, skewing the number of incidents and prevalence of RSS events, as most of the RSS events were voluntarily reported to TJC (Steelman et al., 2018). Another weakness of that same study identified by Steelman et al. (2018) was incomplete or missing information on some reports, undermining the value of the study. In addition, search terms and keywords were not exhaustive; thus, it is probable that some sentinel events were missed. This study was a valuable resource for this investigator's surgical patient safety project as it detailed the prevalence of retention incidents and harm to affected patients.

Retrospective Study of Retained Foreign Bodies Over 3-Year Period

There are significant risk factors related to unintentional retained foreign bodies (RFBs), as outlined in a retrospective study by Zarenezhad et al. (2017). RFBs are preventable surgical errors that are not well understood, and retained items have been detected regardless of surgical counts documented as correct. In this study, the evidence collected was analyzed as descriptive, nonparametric data and compared with the chi-square analysis application (Zarenezhad et al., 2017). Surgical sponges were the most significant and frequent RFBs and can have broad clinical manifestations, including mortality and morbidity. Zarenezhad et al. (2017) found that RFB errors could be adequately decreased by standardizing surgical counting processes and refining patient safety protocols with the compliance of all OR staff.

Observational Study Centered on Surgical Safety Checklist

One tool designed to reduce surgical errors was the surgical safety checklist (SSC) developed by the World Health Organization (WHO) in 2008 to strengthen multidisciplinary communication in the perioperative department and bolster safe patient outcomes (Ziman et al., 2018). Conley et al. (2011) described the SSC as consisting of three parts: *briefing* or si*gn-in* (before induction), *time-out* (before skin incision), and *debriefing* or *sign-out* (before patient leaves the OR). Ziman et al. (2018) based this study on triple research questions that were meant to determine the following:

- how the multidisciplinary team members in the OR viewed the value of SSC items,
- their perceptions of the benefits of SSC compliance, and
- how the importance of patient involvement was anticipated by team members.

Additional findings in Ziman et al.'s study (2018) were based on the exploration of protocols and the complex culture that exists in the OR.

By choosing an ethnographic methodology, Ziman et al. (2018) identified the beliefs, attitudes, and values of OR team members as related to their complex work environment. This allowed researchers to closely observe interactions and behaviors of their everyday work life while establishing what "health professionals say they do and what actually occurs in practice" (Ziman et al., 2018, p. 576). Data collection consisted of ethnographic observations for more than 50 hours in 14 surgical procedures. Observations in the OR were performed by two appraisers that represented both *insider* and *outsider* stature, thereby strengthening the study's validity. The observational template was modified after completing investigative assessments, enhancing the rigor of data collection (Ziman et al., 2018).

Data were analyzed by an inductive thematic approach, and researchers reached conclusions by examining patterns and themes that emerged. Ziman et al. (2018) reported that the analysis of data was stimulated by two concepts: collective competence and safety culture. Collective competence is a complementary concept of moving from competent individual experts to collaborating with other clinicians to create and use a collective knowledge base. Safety culture is a collection of values, competencies, and patterns of behavior that describe an organization's commitment to safety management (Ziman et al., 2018). The literature review was adequate, as findings from previous studies clarified the effectiveness and execution of the SSC. Consequently, Ziman et al. (2018) maintained that sufficient education and training of surgical team members on crucial practices for preventing RSIs was inadequate. Existing literature lacks data on the frequency at which *the count* detects discrepancies, such as miscounts in the OR. The relevance of this research study was significant in supporting the implementation of specific RSI training and education strategies in the OR and providing findings that highly correlate with the topic of interest.

Systematic Review: Ineffective Communication Recurring Theme

The universal protocol, enacted by TJC in 2004, is a guide for healthcare professionals with the intent of preventing wrong-site surgery, wrong procedure, and wrong-person surgery. It is applicable to all surgical or invasive procedures, although the setting may be outside the surgical suite (cardiac catheter lab, labor and delivery, and interventional radiology). Hempel et al. (2015) retrieved publications from 2004, the year the universal protocol was introduced, to 10 years later, in 2014. The study intended to chronicle, examine, and summarize findings from past relevant studies to convey a clear, comprehensive overview of pertinent and available evidence, including dissecting the root causes of the aforementioned surgical *never events*. Previous studies

were explored by the researchers to provide incident estimates, scrutiny of root causes, and outcomes related to universal protocol (UP) interventions.

There were 138 empirical studies included in this systematic review by Hempel et al. (2015) of surgical never events, with certain studies reporting more than a single event. Four studies affirmed that RSI events occurred in defiance of surgical counts recorded as correct and radiography performed. Nineteen analyses determined numerous root causes and risk factors that included poor staff communication, specific case characteristics (such as emergency procedures), defective policies, and variables concerning equipment (Hempel et al., 2015). Ineffective communication in the OR was the recurring theme as the fundamental cause of RSIs (Hempel et al., 2015). Competing responsibilities and tasks in the OR have been identified as contributors to the inattentiveness of staff. Hempel et al. (2015) established undocumented or incomplete surgical counts as contributing factors to RSIs as well. Several institutions reported events due to equipment issues, nonstandardization of count policy, and items that were not counted routinely left behind in patients (Hempel et al., 2015).

Multivariate analyses methods were used to determine an independent association between procedural duration and unexpected events related to the surgery. Another important predictor in multivariate analyses was patient body mass index (BMI). One strength of this publication is that it is a systematic review, offering an abundance of investigative evidence to clarify and strengthen previously published outcomes; therefore, giving it reliability (Hempel et al., 2015).

The authors (Hempel et al., 2015) identified 17 publications that analyzed 18 interventions to prevent RSIs. Types of interventions focused on count protocol, count and radiography policies, educational and training approaches, improvements in equipment policies,

coded sponge-counting systems, bar-coded sponges, radiofrequency identification (RFI) detection systems, and meticulous surgical count campaigns (Hempel et al., 2015). The review scope was limited to a literature search of English language publications. Research projects are flawed if there is an inadequate sample size and follow-up data, data with no correlative statistics, and imprecise and variable reporting of events that should have a common factor (Hempel et al., 2015).

A standardized reporting system is nonexistent; however, reporting mandates have been implemented by many states to improve the approximation of RSI events, which is estimated to be 5,000 annually in the United States (Hempel et al., 2015). This systematic review was a valuable publication that documented influential research on RSIs and assisted surgical healthcare professionals to understand better causes, preventive efforts, and effects of interventions. It was an outstanding article that highlighted risk factors, including a comprehensive list of interventions to reduce or eliminate RSIs (Hempel et al., 2015).

Retained Surgical Items in Spinal Surgeries

Historically, RSIs have not been reported in spinal surgeries, and there is little literary evidence related to spine surgery cases (Reddy et al., 2019). A clinical study by Reddy et al. (2019) at a spinal injuries center collected retrospective data from the hospital and thoroughly screened the evidence for confirmation of RSI in spinal surgeries from January 2013 to December 2017, in which cottonoids were used. Cottonoids are soft, pliable, absorbent neurosurgical patties that have X-ray detectable markers and are frequently used by neurosurgeons for hemostasis (Reddy et al., 2019). This study focused on the persistent problem during and after spinal surgery of missing cottonoids. The focus of the study was to utilize the case reports to outline a sequence for locating misplaced cottonoids in the spinal surgery setting,

calculate risk factors, and create an algorithm for resolving the dilemma. Reddy et al. (2019) found minimal evidence in the existing literature on the incidences of RSIs in spinal surgery, using these keyword search terms: *cottonoids*, *surgical sponges*, *spine*, *re-exploration*, *retained foreign body*, and *algorithms*.

For the 5-year period under study, Reddy et al. (2019) determined that 7,059 spinal surgeries were performed. There was an incidence of missing cottonoids once in every 471 cases, accounting for 15 miscount cases (Reddy et al., 2019). All but three cottonoids were located on the floor under not only the surgeon's shoes but under the assistant's shoes, one was located in the surgical field, and one was found twisted in the interbody cage site in the patient. The last cottonoid was never located and the lumbar fusion wound was closed after a thorough search, with documentation of the incident by the surgeon (Reddy et al., 2019). The patient complained of severe radicular (lumbosacral) pain on the first postoperative day and was subjected to diagnostic imaging in an attempt to detect the problem. Magnetic resonance imaging (MRI) indicated the possibility of a foreign body. The neurosurgeon reopened the surgical wound to explore the surgical site but did not discover the cottonoid; however, the patient's pain was subsequently alleviated (Reddy et al., 2019).

Spinal procedures fraught with inconsistencies in procedural counts involving cottonoids were included in the study by Reddy et al. (2019). Excluded from the study were surgeries considered minimally invasive (such as percutaneous procedures). The large sample (7,059 patients) enabled Reddy et al. (2019) to gather more comprehensive data for their study, and this gave strength to their investigation. This study did not offer as much value as some of the others, but the search algorithm that was developed can potentially be beneficial to OR teams.

The SSC was followed per protocol. The researchers were motivated to develop a systematic search algorithm based on where the missing cottonoids had been found to reduce potential patient harm from retained cottonoids during spinal surgery procedures (Reddy et al., 2019). The process consisted of successive steps that involved recounting and searching comprehensively for the misplaced items to resolve any count discrepancies. The algorithm was designed to avert staff confusion and to ensure team members collaborated to achieve this common goal. This retrospective study resulted in the development of a search algorithm as a practical implication that may be beneficial in preventing RSIs in spinal surgery settings (Reddy et al., 2019).

The primary surgeon should routinely explore the wound in a methodical sequence to make certain nothing is left behind, and fluoroscopy is available intraoperatively as another cautionary measure to prevent RSIs (Reddy et al., 2019). Small cottonoids can be extracted through suction tips when irrigating the wound either routinely or with abrupt blood loss. Suction canisters should always be checked when counts are incorrect (Reddy et al., 2019).

The incidence of RSIs in spinal surgery is unclear, while other surgical specialties estimate 1 in 5,500 cases (Reddy et al., 2019). RSIs produce undue emotional, physical, legal, and financial consequences for patients. Surgical safety is the collective objective of surgeons and OR teams in every surgical setting. Preventable surgical errors continue to happen and can potentially unleash devastating consequences on patients while leaving healthcare teams and organizations vulnerable to harsh ramifications (Reddy et al., 2019). The proposed project aligned accordingly with this investigator’s professional experience and expertise.

Conceptual Framework: Adult Learning Theory

The academic learning theory of andragogy can be described as the established process of engagement for adults in continuing education (Bouchrika, 2024). Health professionals use the adult learning theory through the facilitation of skills development and knowledge associated with parent education to teach them to care for their children (Thompson et al., 2020). This is achieved through collaborative teaching and learning principles while recognizing the capabilities and understanding of parents. Their learning experiences may differ from one another, but the adult learning theory offers opportunities for them to engage in evidence-based education to improve the health of their children and supports the philosophy of education for adults as learners (Thompson et al., 2020).

Mukhalalati and Taylor (2019) asserted that the andragogy theory is also applied in healthcare professional education as a concept that describes "an individual's acquisition of knowledge, skills, and attitudes to achieve changes in behavior, performance, and potential" (p. 1). Knowles' ideas focus on what learners already know and what they subsequently learn, which are significantly important in professional education. Application of the most effective learning theory should be appropriate for constructing new knowledge in their learning environments based on the foundations of existing knowledge (Mukhalalati & Taylor, 2019).

Factors that advance andragogy are supportive engagement, dialogue and relationships, personal and communicative needs, and the teaching–learning process (Loeng, 2018). The enactment of the adult learning theory has been viewed as a mechanism for social change through the continual promulgation of knowledge and know-how for the express purpose of investing in the learners' talents as sustainable resources (Biao, 2021; Loeng, 2018).

Conceptual Framework for Education Program

The conceptual framework for this study was based on the adult learning theory (aka andragogy) rejuvenated by Malcolm Knowles in the 1960s (Bouchrika, 2024). Andragogy has been broadened to include new approaches, such as online learning, enabling learners to transition to self-directed, independent study. Adult learning can be differentiated from *pedagogy*, the manner in which children learn, by recognizing the interplay from the perspective of the adult's life experiences, social and cultural influences, and life situations (Kurt, 2020). Relevant characteristics that apply to the adult learning theory include the following:

- Self-concept: Adult learners are independent, autonomous, and self-directed.
- Immediate applications: Task-oriented, problem-centric, and life-focused learning is most appealing to adult learners.
- Learning from experience: Adults have a rich resource in their previous experiences, including their mistakes.
- Readiness to learn: Adult learners are inclined to learn what is of most significance to them, and their readiness is highly connected to their social roles.
- Need to know: Adult learners want to know the value of what they are learning and the whys behind the curriculum.
- Internally motivated: Adult learners are motivated by intrinsic factors and not by external pressures (Bouchrika, 2024).

Andragogy is based on two principal-defining characteristics: the first is that adult learners are sovereign, self-reliant, and self-directed, and second, the teacher acts as a facilitator rather than presenting content to the learner (Bouchrika, 2024). The teacher-centered approach is regarded as a more passive transfer of knowledge as the learner has minimal input, whereas the

andragogy framework supports learner-centered precepts (Bouchrika, 2024). Its central thesis is that the theory is learner-centered and experience-driven, thereby emphasizing future purpose-driven applications (Loeng, 2018). Academic learning for adults has become a widely accepted theory by educators and can be described as the established process of engagement in continuing education rather than basic restorative education.

Adult learners are passionate about applicable knowledge and have a natural inclination to learn subject matter that is of the greatest significance to them, thus contributing to their holistic centermost advancement (Bouchrika, 2024). Personal motivation and social interactions integrated with the learner's personal interests, self-attributes, and deliberate motives are highly reflected in the adult learning process. When the subject content is useful and relevant, adult learners will retain it best, thus acknowledging the purposes for learning specific skills or tasks. Adult learners are adept at developing solutions to real-life circumstances: solving problems, accelerating applications, and performance-based activities are essential elements of effective methods (Kurt, 2016). The andragogy conceptual framework was a valuable model for adult learners in the OR when introducing standards-based practical knowledge, visual illustrations and pathways, practical audit tools, and relevant benchmarking methods for tracking performance.

Evaluation Framework

The training evaluation framework was based on Kirkpatrick's four-stage model of the evaluation of continuing education effectiveness and depicted as four guiding principles (Andreev, 2023). The model can be implemented before, during, and following the intervention (see Appendix A). The techniques of evaluation provided the tools to adequately gauge learning in the contexts of reaction, learning, behavior, and results and included the following:

- **Reaction.** Participants are reactive in a favorable and engaging way, viewing the training as relevant.
- **Learning.** Participants are actively committed to participating in the training and gaining the intended skills, knowledge, attitudes, and confidence.
- **Behavior.** Participants apply the knowledge and skills they learned during their training when they are on the job.
- **Results (Performance).** Participants are able to visualize the intended outcomes relative to their training, support, and sense of accountability.

For this study, the first two levels of reaction and learning were determined, and the remaining two levels of behavior and results were to be implemented by the host facility after the conclusion of this investigator's project.

Chapter Summary

The circulating RN relies heavily on "the count" as the principal mechanism for preventing RSIs, but it alone is unreliable. Patient safety is greatly compromised if, for whatever reason, the RN deviates from the recommended count process. Flanagan (2019) maintained that surgical counting is integral to safe intraoperative nursing practice. The RN circulator is responsible for ensuring that all surgical soft goods, needles, sharps, and instrumentation are accounted for during the surgical procedure. The risk of something being left behind within a body cavity can be disastrous and cause irreversible harm to the patient (Flanagan, 2019).

The target population was OR nurses and STs (aka scrub techs) working in the OR. The objective was to implement an educational intervention to eliminate potential inaccuracies and involve every surgical team member in the accounting process. One of the most relevant imperatives in healthcare today is patient safety; however, it is challenging to overcome the

underlying problems that threaten safe healthcare environments. The next chapter will discuss the methodology and design of the educational intervention.

Chapter 3: Research Methods

Surgical care-related errors are important safety considerations for operative team members but continue to occur at distressing rates. In the United States, human factors are the chief determinants of surgical errors; for example, counting procedures in the OR can be unpredictable and unreliable, creating count discrepancies, near misses, and unintentional RSIs (Landers, 2015). There is clear consensus that to ensure successful strategies to keep patients safe, healthcare professionals must be diligent, transparent, and demonstrate accountability in their roles as caregivers. RSIs can go undetected for months or remain dormant for years, making it difficult to determine an accurate number of incidences annually (Zarenezhad et al., 2017). Time lapses between surgical procedures and actual detection of RSIs differ broadly (from same day to years later), with presentations that may be either vague or exhibit severe symptoms. In addition, inconsistent disclosure and grossly underreported incidences of RSIs hinder a true account of these events. This chapter outlines fundamental methods used to develop, design, and introduce a staff education program into the OR.

Purpose

The purpose of this project was to deliver an educational intervention centered on the prevention of RSIs in patients undergoing surgery or invasive procedures. The educational program was developed in collaboration with OR leaders. OR nurse circulators and STs were the targeted recipients who received comprehensive RSI education and training. The scope of the proposed project was limited to the development of an educational intervention for OR teams in one suburban hospital in the Southern United States. The template of the educational design introduced a step-wise approach for planning and implementing the educational intervention to generate viable, evidence-based results.

Project Design

This proposed staff education program was designed as a relevant strategy to complement the existing understanding of RNs, nurse residents, and STs in relation to advancing counting practices in the OR. Staff education is often used to enhance knowledge and sharpen clinical skills related to best practice. This proposed educational intervention was specifically designed to elevate attention and awareness in the operative suite by promoting teamwork and eliminating communication failures. Implementation of the educational intervention was the most appropriate and effective design to achieve the desired outcomes in a dynamic surgical environment (see Appendix B). The informational characteristics of the program were designed to be beneficial to the team's daily routines.

An educational program based on EBP was designed based on AORN Perioperative Standards and delivered to OR personnel; pretest and posttest questionnaires were used prior to implementation and at completion of the program, respectively. The intention of the program was to align OR personnel's knowledge with best practices related to RSI education and training and to reduce or eliminate RSIs. System and process changes require comprehension of change theory, methods of facilitation or interference of change, success of change steps, and tactics to further individual steps (Tucker & Melnyk, 2019).

The project intervention was based on relevant educational teaching techniques derived from AORN standards that address the program goals of increasing knowledge related to unintentional RSIs and eliminating errors in the OR that result in these events. The educational intervention was verified with perioperative leaders of the organization and supported by end-users via a formative anonymous questionnaire. Development of the patient safety curriculum objectives (staff education program) consisted of substantial content and the appropriate strategy

for delivery using suitable methods for instruction and components of an appropriate framework (adult learning theory).

Preliminary Components of Educational Training Module

- Define the objectives of the education program and the details of informed consent.
- Initial knowledge and self-efficacy assessment.
- The scope of retained surgical items, patient, and organizational consequences.

  View video by Dr. Verna Gibbs, surgeon who developed “NoThing Left Behind®”.

Video can be viewed on YouTube at https://www.youtube.com/watch?v=44SFY_nodrQ.

  The program advocates for all OR personnel to be accountable for counting every item.
- Review the AORN standards of practice and regulatory guidelines.
- The identification of unintentional retained surgical items, causative factors, and appropriate level of intervention.
- Explore existing counting practices and need for change. Introduce literature recommendations and timeframe target date for change.
- Provide RSI education and training for OR nurses and STs that includes steps for conducting surgical counts while simultaneously documenting counts on the whiteboard in the OR.
- Various adjunct technologies will be discussed as detection systems that can be used in concert with manual counting, including the use of only radiopaque items in surgery.
- Introduction of tools and pathways to use to facilitate quality care and standardization.
- Emphasize collaborative teamwork and effective communication skills reinforced through educational methods to indoctrinate OR team members with techniques to manage productive dialogue. This instruction will empower staff members and enable

them to boost self-efficacy and self-confidence.

- Introduce benchmarking tools for quality review and tracking.
- Final knowledge and self-efficacy assessment.

Planning Strategies

Planning strategies included analysis of the need to establish criteria for the planned education intervention and predicated on EBP, existing data, hospital site feedback, and theoretical support. The PICO practice-focused question provided the nucleus for the project and guided its progression. Discussion of needs with respect to current OR counting practices and staff education goals with perioperative and organizational leadership contributed to the development of the educational program. Obtaining commitment of support from the organization's senior leadership and perioperative leaders was imperative, and explicit learning objectives were mutually defined.

Evaluation

Nurse and tech participants completed a self-report quantitative questionnaire before and after the focused RSI education and training for purposes of evaluating their level of learning based on specific learning objectives related to unintentional RSIs. This was an anonymous online questionnaire. The pretest and posttest questionnaires were compared to demonstrate the effectiveness of the educational program campaign.

Methodology Appropriateness

Quantitative correlational research design was the most relevant mechanism for the cross-sectional collection of data from a representative subset of OR personnel at a given point in time and for making inferences about the population of interest. The design focused on interpretive descriptive data and was obtained using self-report survey questionnaires. Quantitative research

methods include collection, tabulation, summarization, and analysis of numerical data for the purpose of answering research questions (Bhandari, 2023). This type of research can determine if exposure to a specific "variable of interest" (RSI education program) can correlate to a "precise outcome" (enhanced knowledge and self-efficacy). Critical goals of this study consisted of characterizing the optimum intervention and its parameters. Results of the pretest and posttest questionnaires were tabulated.

Instruments

Pretest and posttest questionnaires were administered anonymously to 10 volunteer OR team members to assess their existing knowledge and subsequent knowledge following the intervention. The tool used was an evidence-based, validated questionnaire adapted from the 2023 Competency Verification Tool developed by the AORN for perioperative services to prevent RSIs. The tool included predetermined questions, of which 20 items were appropriate for the pretest and posttest. Permission for use of the instrument was approved by the AORN (see Appendix C), and this reliable tool was chosen to measure levels of knowledge and self-efficacy of OR nurses and STs before and after the educational program intervention. Distinct variables associated with attributes of the participants explored EBP knowledge (deficit or enhancement) and supported a systematic approach to decision-making related to quality patient care (Crawford et al., 2020).

The pretest questionnaire was provided to 10 OR team members (see Appendix D): one nurse educator, two nurse leaders, three RN circulators, and four STs to evaluate their knowledge related to RSIs, counting procedures, all aspects of team practices regarding counts, adjunct technologies, and communication techniques. The posttest questionnaire assessed whether or not the participants benefitted from the education program (see Appendix E). Participation in the

education intervention was voluntary, but consent was acquired from participants, and confidentiality was maintained by asking each participant to select a specific identifier for matching the pre- and posttest results. Quantitative methods were applied to compare and analyze variations unveiled between the initial and final survey questionnaire results. Reliability of the instrument was determined by its ability to measure consistently, and the concept of validity was apparent by the accuracy of the measurement (Middleton, 2023). Training effectiveness was measured by the Kirkpatrick evaluation model that delineates four levels of evaluation: reaction, learning, behavior, and results to assess change in learner knowledge, attitudes, and skills (Heydari et al., 2019).

Data Collection, Management, and Analysis Plan

The identities of staff participants and their responses to the questionnaires were not disclosed, as the questionnaires were administered and collected anonymously. De-identified data are being stored under the investigator's name and owned by Abilene Christian University (ACU) in case access is needed at a future date. Participants selected a specific identifier (pseudonym) to match the pre- and postquestionnaire results. The data were collected from the pretest and posttest questionnaires and examined according to appropriate analytic methods. Calculations were indicative of knowledge assessment and performance measurement.

Feasibility

This process improvement project was feasible within the timelines, parameters, and context of program design. Implementation required solid commitments from relevant stakeholders, which was agreed to by organizational leadership, OR leaders and educators, and the surgical workforce. The viability of innovative strategies, the availability of adjunctive detection technology, and the potential to generate positive returns were practical assumptions of

this proposed plan. Support, commitment, and effective partnerships with key stakeholders bridged the gaps with the articulation of the process for implementing RSI education and training for OR teams. Team members demonstrated engagement with the objective to improve patient outcomes and contributed to achieving its success. Logical assessment (discerning risks and benefits) minimized the potential for intervention failure. It was incumbent upon the investigator as program lead to engage with perioperative leaders and stakeholder groups to align collaborative efforts for improving surgical counting practices. Cultivating cooperation and support for enhanced outcomes was a priority.

IRB Approval and Process

A suburban community hospital located in the Southern United States served as the host organization. The project involved human subjects but only in the capacity of recipients of education and training, not as patients. The host organization approved this project under the auspices of their own internal quality improvement plans regarding the same topic. The proposal was submitted to the institutional review board (IRB) at ACU and approved for exempt status.

Interprofessional Collaboration

Interprofessional collaboration offers health professionals new learning opportunities to share in interactive learning with other clinicians to augment a safer and more patient-centric OR environment. Working together cooperatively promotes team-based strategies as a collaborative effort to ensure that OR personnel work as a cohesive team to meet the healthcare needs of their patients. Major stakeholders may include organizational and system leaders, OR nurses, OR nurse residents, physicians, clinical educators and preceptors, STs, and administrators of the department of nursing. The expectation was that the blueprint would be successful by innovating and improving the educational preparation of surgical staff. And, as a result, indirect

stakeholders identified as patients, healthcare employers, and the perioperative community would benefit.

Practice Setting

The host organization was a suburban community hospital located in the Southern United States. The campus operative suite was host to 10 surgical service lines and had a total of 12 ORs. Surgical team participants included both men and women who were all English-speaking, and there were no stipulations regarding the length of their employment in the OR. The educational offering was developed and delivered as planned. The surgical environment described was the primary setting for introducing and delivering the staff education program.

Target Population

The target population was specific individuals in the OR who received focused RSI education and training. The criteria for participants were RN circulators/scrubs, nurse residents (if applicable), and STs who worked in the OR, including nurse leaders and educators.

Timeline

Literature review and project planning began in July 2020. The timeline was delayed by 2 years due to the COVID-19 pandemic. Most elective surgeries in hospitals were halted with stringent restrictions implemented for patients and visitors to mitigate exposure and rapid spread of the coronavirus disease. Once the project evolved, the study substantiated the critical need for more comprehensive education and training on RSIs in the operative environment. Once the worst of the pandemic was considered to be over in late summer 2023, the project seemed to be again underway.

The original site for the project was located in the Southeastern United States, but it became apparent after 6 weeks passed without data submissions or communication that the vice

president of surgical services was no longer supportive of the project. The agreement was terminated, and the search for a new site began. Three months passed before the new site was found. As expected, the holidays impacted the timeline, but persistent motivation was key to being successful. A 2-day time period was needed for OR staff participants to complete the pretest, participate in the delivery of the 120-minute educational curriculum, and complete the posttest. OR nurses generally complete a perioperative nurse residency program prior to working independently in the OR without a preceptor or coach. A more precise and polished educational curriculum in the operative environment is recommended to achieve the safest outcomes possible.

Risks

Potential risks included typical barriers or challenges that emerge as with any implementation of change. In the OR, these can include communication failures, toxic culture, disruptive behavior secondary to hierarchy related to the tenure of team members, staff resistance and reluctance to "buy in," or poor staff engagement. These barriers can impede the progress of a given project or sabotage the effectiveness of an educational intervention.

Benefits

Engagement of RN circulators and STs in the delivery and acceptance of the proposed intervention was greatly beneficial. Participants were positive and eager to learn new concepts relative to their work roles. Optimistically, the application and enculturation of best practices were integrated with systematic, reliable, and standardized processes to mitigate potential counting errors in the OR. Aspects of sustainability included the ability of the OR personnel to maintain their core values and adapt to the concepts of their new education and training. As a result, professional efficiency generates pride in one's work, and job satisfaction produces

improved performance and productivity. The last two levels of the Kirkpatrick model will be evaluated 3 to 6 months following the conclusion of the project (Andreev, 2023).

Chapter Summary

The educational approach included principles of frequent feedback and challenging staff assumptions to deepen their critical thinking. The resulting expectation after implementing the educational program was that actual RSI events, near misses, and miscounts or count discrepancies would be substantially less, and communication in the OR would be more concise and effective among team members. An exceptional platform for improving patient safety in the OR would be to incorporate efficient assistive technologies to facilitate the manual counting process. Chapter 4 will discuss the findings related to this Doctor of Nursing Practice (DNP) project.

Chapter 4: Results

Patients who undergo operative and other invasive procedures are highly susceptible to unintentional RSIs, thus rendering them defenseless against significant infection and mortality risk (Pyrek, 2022). Surgical teams are highly skilled, yet prevention of RSI surgical errors remains largely elusive. Items unintentionally left behind after the incision has been closed are significant surgical errors. TJC reported that most RSI sentinel events submitted between 2005 and 2012 were due to either failure to subscribe to preventive policy or its complete absence (as cited in DeWane & Kaafarani, 2023). Accordingly, such *never events* have been interpreted as a distinct category of preventable human error predicated by ineffective communication, inadequate safety culture, and flawed policy (DeWane & Kaafarani, 2023).

This study was meant to address the gap in OR clinical practice by developing and delivering a standardized educational program to specifically target counting practices that would decrease the risk of RSIs. The proposed project was intended to answer the PICO question as to whether or not an evidence-based educational program would improve the knowledge and self-efficacy of surgical nurses and technicians in unintentional RSI prevention. Misplaced surgical items may include gauze products, sharps, instruments, or device fragments and may have been accidentally left in the patient by the surgeon (Fogle, 2023). Despite focused effort and implementation of thorough processes by surgical teams, these never events continue to occur (Fogle, 2023).

Data Analysis Procedures

Data values were defined as paired measurements of knowledge and self-efficacy levels taken before and after the educational intervention (Pallant, 2020). The assumption of the dependent variables *t* test was that the differences between pairs of matched scores were

normally distributed (normality). In conducting parametric statistical techniques, including *t* tests, the "skewness" value offers an explanation of the distribution's symmetry. Normality relates to the distribution of data and the assumption that the data will follow a symmetrical bell-shaped curve (Pallant, 2020).

The paired-samples *t* test uses the average difference between the matched pairs (variables) to calculate the *t* statistic, which is then used with the *df* to compute the *p*-value. The *p*-value indicates the significance level. This statistical procedure was an appropriate method to determine whether there was a significant difference between the mean scores measured on two occasions. According to Pallant (2020), the pretest and posttest quasi-experimental design describes when study participants of the same group are assessed on a continuous measure at two time points (Time Point 1 and Time Point 2). The education intervention was presented to the group as the experimental manipulation between Time Point 1 and Time Point 2 (Pallant, 2020). Design of the intervention was to impact participants by enhancing their knowledge and self-efficacy as related to unintentionally retained surgical items. The Statistical Package SPSS software was utilized to test the outcome data (hypothesis) based on the paired-samples *t* test (variables).

Interpretation of Paired Samples t*-Test Output*

Paired (dependent) samples *t* test was used to establish significant differences between two scale variables that could be matched. The result is based on an alpha level of $a = 0.05$; $t(9) = -4.61$ with the *p*-value = .001. Therefore, the null hypotheses could be rejected. This finding supported the differences in Variable 1 Pretest and Variable 2 Posttest as not likely to have been produced by a normal distribution as previously stated, signifying there was a violation of the assumption of normality. The result implied that the difference in the mean of Variable 1 Pretest

and the mean of Variable 2 Posttest was significantly different from zero. Additionally, the mean of Variable 1 Pretest was significantly lower than the mean of Variable 2 Posttest, which supported the results as being statistically significant. Table 1 presents the results.

Formula for Paired-Samples* t-*Test (Pallant, 2020)

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s/\sqrt{n}}$$

$\bar{X}_1$ = sample 1 mean
$\bar{X}_2$ = sample 2 mean
s = sample standard deviation
n = sample size

Table 1

Results of Two-Tailed Paired-Samples t *Test for the Difference Between Dependent Variable 1 Pretest and Dependent Variable 2 Posttest*

Dependent Variable 1 Pretest		Dependent Variable 2 Posttest				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
87.00	9.78	99.00	3.16	-4.61	.001	1.46

Note. N = 10. Degrees of Freedom for the *t* statistic = 9. d represents Cohen's d.

When statistical significance is tested in both directions, the two-tailed test method is applied. When testing the relationship in either direction, the alpha is split in half. Hence, the means between the two variables are tested to determine if the first variable (pretest) is greater than or less than Variable 2 (posttest). It should be noted that a nonsignificant finding could be the result of a small sample and insufficient power.

Purpose of Project

The purpose of this safety project was to develop and deliver an evidence-based program to surgical nurses and technicians that would improve their knowledge and self-efficacy in preventing RSIs. Risk-reduction strategies included the improvement of system reliability to

reduce human errors. Specifically, effective communication techniques and compliance with policies and procedures should reduce errors and improve the safety of surgical patients (Pyrek, 2022). In a study by Steelman et al. (2018), contributing factors related to RSIs were explained as communication breakdown, ineffective leadership, and human factors.

It has been suggested that stressful situations in the OR may cause RSIs to occur more frequently (Pyrek, 2022). For example, unexpected changes in the scheduled procedure may impact conditions and team dynamics, such as communication, mindfulness, teamwork, and collaboration. Threats of RSIs can also result from staff complacency and inattentiveness. Interdisciplinary interventions should focus on enhancing system culture and human factors to reduce the risk of RSIs (Pyrek, 2022). The AORN recommends a systems approach for cultivating optimal outcomes and supports the use of adjunct technology to assist in the prevention of retained soft goods, reduction in time spent with reconciliation of count discrepancies, and utilization of radiological imaging (Pyrek, 2022).

Demographics

Specific participant demographics were not collected as this component was unessential to the study. As an important element of any research, broad generalizability of results is desirable but may require large and varied datasets. Making predictions founded on recurring experiences is a practical definition of generalizability (Littell, 2024). Typically, the purpose of a research study is to achieve generalization from collected data to produce a comprehensive conclusion about a specified population. Generalization in research can be influenced by the sampling and representativeness; thereby, at a very minimum, the sample should take into account characteristics that represent the population being studied (Littell, 2024).

At the completion of the research, a similarity or link between the population and the study should be present in terms of the sample's characteristics and the treatment environments (Littell, 2024). The only known personal characteristic was that the 10 participants were either RN circulators or STs employed in the 12-room operating suite of a community hospital located in North Texas. Ten service lines are served in these ORs, which include general surgery, urology, gynecology, plastics, gastrointestinal procedures, back and spine, orthopedics, ENT (ears, nose, and throat), ophthalmology, and vascular, some of which are highly complex procedures.

Data Collection

A pretest questionnaire was administered to 10 OR team members (N = 10): one nurse educator, two nurse leaders, three practicing RN circulators, and four STs to evaluate their knowledge related to counting procedures, communication techniques, all aspects of team practices regarding RSIs, and adjunct technologies. The posttest questionnaire was intended to assess whether or not the participants benefitted from the educational program. Participation in the education intervention was voluntary, but consent was retrieved from participants, and confidentiality was maintained by asking each participant to select a specific identifier (pseudonym such as "Wonder Woman" or "Iron Man") for matching the pre- and posttest results.

Participants who voluntarily agreed to share in this study were asked to sign the consent only after reading all of the information provided. Individuals were assured that signing the consent form did not waive any of their legal rights. In accordance with the electronic consent platform, "signing" the consent was achieved by typing their birth month and day ONLY, such

as July 15 = “0715,” which was acceptable for this study rather than their actual signatures. No other personal identifiers were requested from participants.

Data Analysis

Further determination of whether the differences in Variable 1 Pretest and Variable 2 Posttest produced by a normal distribution were realized by conducting a Shapiro-Wilk signed rank test. Results of the Shapiro-Wilk test were significant based on an alpha value of .05, $W = 0.84$, $p = .050$. This nonparametric test is an alternative to the paired-samples *t* test but does not share its distributional assumptions. This result also suggested the differences between the variable means were unlikely to have been produced by a normal distribution, indicating a violation of the normality assumption. The two-tailed Wilcoxon signed rank test was simultaneously conducted to examine the difference between the variables. Results of the two-tailed Wilcoxon test were significant as well based on an alpha value of 0.05, $V = 0.00$, $z = -2.56$, $p = .011$, which implied that the differences between the dependent variables were not likely due to random variation. Both tests concluded that the output of the *t* tests was statistically significant.

The Kirkpatrick Evaluation Model

The Kirkpatrick evaluation model is a simple four-step process widely used by organizations and industries to examine training effectiveness (Andreev, 2023). Its concepts are simplistic yet relevant to provide clear evaluative steps for the investigator to follow. As a popular program evaluation model, the credibility of the process was trusted. For this study, perioperative leaders and OR personnel were expected to gain valuable insights into the impact of a specific training program and how it affected outcomes (Andreev, 2023). Multifaceted,

complex determinants that can result in unintentional RSI events are often complicated to dismantle. This model is effective in assessing the efficacy of an education and training program.

Level 1 of training evaluation is *reaction*: this step determined employee reactions to the educational program and their engagement in the process (Andreev, 2023). It is crucial to understand how employees perceived the focused training, which provided insight as to what worked well or needed improvement. This level measured engagement, relevance, and satisfaction of the learner. Evaluation survey forms were promptly provided for staff members who participated in the pretest and posttest surveys and educational intervention.

Level 2 of the Kirkpatrick evaluation model is *learning*: this step measured to what extent the participants learned or did not learn from the program (Andreev, 2023). Hence, to effectively achieve this measure, participants were tested before and after the intervention to determine progress (pretest and posttest surveys). This level explicitly measured confidence, skills, acquired knowledge, attitude, and commitment (Andreev, 2023). The most practical question contemplated was: *Were the learning objectives realized?* Measures were derived from a comparative analysis of the pretest and posttest scores.

Levels 3 and 4 of the evaluation model, *behavior* and *results*, respectively, were left to the organization to evaluate after completion of the investigator's project. The *behavior* level would gauge whether or not the educational program had impacted the behavior and performance skills of study participants (Andreev, 2023). Consequently, it could potentially take an unspecified amount of time to apply their knowledge. The final level of the model was to measure *results*, the stage that would evaluate the impact the behavioral changes had on positive outcomes (Andreev, 2023). Andreev (2023) postulated that these results would be most effective

3 to 6 months after the education and training; if evaluated too soon, the data would likely be unreliable.

Question Guiding the Inquiry

The research question guiding the project was, “Does an evidence-based educational program improve the knowledge and self-efficacy of OR nurses and STs in the prevention of RSIs?”

Hypotheses

- Hypothesis 1: The education program improved the knowledge of OR nurses in the prevention of RSIs.
- Null Hypothesis 1: The education program did not improve the knowledge of OR nurses in the prevention of RSIs.
- Hypothesis 2: The education program improved the self-efficacy of OR nurses in the prevention of RSIs.
- Null Hypothesis 2: The education program did not improve the self-efficacy of OR nurses in the prevention of RSIs.

Both Hypothesis 1 and Hypothesis 2 were supported by statistically significant data analysis, and the null hypotheses could be rejected.

Limitations of Project

Limitations are challenges encountered in a research study that may not be controlled by the researcher (Stratton, 2019). Rigorous studies should acknowledge limitations to assign context and expose gaps in the prevalent inquiry. Limitations have been identified with the methodology that was applied. For example, the study was confined to one institution, methodological limitations may have been present, and the sample size may have been

insufficient. Random sampling essentially represents a purposeful or convenience sample; therefore, study findings cannot be applied to the general target population but to participants only (Stratton, 2019). However, the popular quasi-experimental methodology has endured for centuries, allowing uncomplicated assessment of a precise treatment applied to study participants (Stratton, 2019). Convenience sampling was suitable for obtaining data and its simplicity was appreciated; however, there can be shortcomings that include bias, risk of low credibility, and sampling error. Otherwise, convenience sampling was favorable. Undoubtedly, RSIs do not have the same degree of severity; for instance, minimal to no harm may occur in some patients and other patients may suffer severe morbidity or even death (DeWane & Kaafarani, 2023).

Chapter Summary

The long-standing practice in the OR of counting sponges, sharps, soft goods, miscellaneous items, and instruments at appropriately designated times during surgery has not eliminated this critical and preventable error. It continues to occur, even when surgical counts have been accurately noted. Enhancing the reliability of the traditional manual count of materials and instruments during surgery requires team training, investigation of technology approaches, and vigilance of the entire team (Moorehead, 2023). Traditionally, new technology has been slow to catch on in healthcare due to the high cost of implementation, data security and privacy, and doubts about whether patients truly benefit from digital tools (Merraine Group, 2023).

However, the emergence of multiple technologies has changed the landscape of surgical counting procedures for hospitals that have adopted one or more systems. For example, radiofrequency identification devices (RFID) have a unique advantage over other technology systems in that they have the “ability to count, locate, and identify surgical items using unique serial numbers” (Fogle, 2023, p. 4). The solution that has the capability to count items within

seconds before, during, and after surgery is the ORLocate Surgical Counting and Detection System, enabling the user to detect surgical items within a body cavity as well as in the kick bucket or trash receptacles. Data-Matrix System (DMS) is a technology that utilizes a code to scan not only the sterile field for the quantity of sponges present but also the number already removed from the sterile field.

The most common unintentional RSI left behind is a gossypiboma or surgical sponge and accounts for the majority of RSIs at 64.1% (Fogle, 2023). When a sponge has been left in a nonsterile site, such as the body's intestinal tract, an exudative inflammatory response resulting in abscess or formation of fistula may develop in the patient (Fogle, 2023). Adhesions, encapsulation, or granulomas that grow relatively slowly are indicative of an aseptic fibrinous response to foreign material in the body (Fogle, 2023). Incidental discovery of RSIs occurs when the patient clinically presents with unexplained pain, abscess formation, symptoms of generalized sepsis, nonhealing wounds, internal fistulas, or symptoms of intestinal obstruction. The latter three symptomatic indicators are more characteristic of delayed responses. RSIs are most commonly left in the abdomen or pelvis (50.2%), retroperitoneal cavity, vagina (23.9%), and chest cavity (in that order) but have similarly been found in the head, brain, neck, and extremities (Fogle, 2023).

Concisely, severe temporary or permanent harm may leave the affected patient with chronic pain, disability, and incomprehensible distress. Stringent counting practices, along with the use of supplemental technology systems, can result in a reduction of near misses and protection against miscounts (Fogle, 2023). Beyond implementing best practices, it is crucial that surgical team members have an increased awareness of meaningful statistics: (a) one of every 65 procedures, a miscount occurs; (b) one of every eight cases, a count discrepancy occurs; and (c)

in the United States, RSI events occur 39 times per week (Fogle, 2023). The final chapter will include a discussion of project results and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

Lack of standardized practice undermines the primary responsibilities of the surgical team, creating the possibility for error to occur. When a surgical element is inadvertently abandoned in the operative wound, the circumstance becomes an error of negligence or malfeasance (Susmallian et al., 2022). Incidences of unintentional RSIs continue to go unreported to minimize exposure to possible litigation and humiliation to the surgeon and associated healthcare organization (Susmallian et al., 2022). Communication failures may hinder effective healthcare and contribute to preventable injury (Rosen et al., 2018). The American public, educators, and policymakers have become increasingly aware of the magnitude of preventable potential harm to patients. These events happen most commonly in acute care settings that include the OR, labor and delivery, emergency room, interventional radiology, and intensive care units. RSIs left in a patient's body may result in a tremendous amount of harm, resulting in pain, infection, damage to other parts of the body, perforation, and death (Primiano et al., 2020). Suboptimal team processes alter the integrity of care provided to patients.

The 120-minute educational session incorporated primary and secondary learning objectives related to unintentional RSIs. Primary objectives for nurses and techs included building knowledge and confidence in relation to RSIs, standardizing count procedures based on best practice, maintaining quality patient care, maximizing operational efficiency, and establishing prevention strategies as a team (Sirihorachai et al., 2022). Secondary objectives included improving team dynamics and team communication, complying with policies and protocols, reducing near misses and discrepancies, and investigating adjunct count technology and current trends in interventions used to prevent RSIs (Sirihorachai et al., 2022).

Improved systems and innovative methods to refine counting practices are greatly needed to identify and track RSIs during surgery (Susmallian et al., 2022). Supplementary interventions should include enhancement of communication and cohesive teamwork as essential components for ensuring patient safety (Susmallian et al., 2022). This safety project was designed to introduce to OR personnel a comprehensive educational program predicated on EBP with intentional strategies for preventing RSIs. Its precise content was intended to build confidence and increase the clinical knowledge of RNs and STs. Initial assessment of knowledge and self-efficacy measures were collected from 10 OR professionals (N = 10) that included one RN educator (n = 1), two RN leaders (n = 2), three RN OR circulators (n = 3), and four STs (n = 4). In this section, findings were collated, and the educational offering was evaluated and established.

Implications of Analysis for Leaders

Healthcare leaders should maintain a heightened awareness of risk factors and consequences associated with unintentional RSIs. Surgical patients continue to be affected by this adverse event; patients remain vulnerable, and no one is excluded from susceptibility. Consequences of how patients are impacted include readmission, pain and suffering, infection, abscess, sepsis, reoperation, and death (Sirihorachai et al., 2022). Moreover, these surgical never events are reported globally, including in Canada, Australia, countries in Europe, Asia, and the Middle East. Implications for nursing leaders are to focus on changes to methods of communication, surgical guidelines, and clinical practice with a strong emphasis on compliance, with integrating smart technology systems to support counting processes more effectively (Sirihorachai et al., 2022).

With consideration given to culture, context, and workflow differences that exist in every OR, standardization of clinical processes and uncompromising compliance will be necessary to negate RSIs (Sirihorachai et al., 2022). Unique characteristics in the various settings make every surgical environment its own subculture. All stakeholders can play a crucial role by actualizing their involvement in developing policy relevant to the process of changing laws and implementing mandates. Findings from this project can further move stakeholders forward with committed efforts to eliminate RSIs (Sirihorachai et al., 2022).

Recommendations for Future Research

Continued exploration of gaps in full compliance and determining reasons for the failure to systematically embrace best practices cannot be fully explained. Radiography protocols are many times not viewed by surgical teams as a mandatory requirement when there is a miscount or count discrepancy (Weprin et al., 2021). Standardized policies of indications for radiography in these circumstances are recommended. Specific protocols to identify damage to surgical instruments and equipment before, during, and after surgery should be based on visual inspection by the ST (Weprin et al., 2021). Incessant research directed at root causes, interventions to minimize RSI events, and mitigation will be integral components in developing future research endeavors.

It is imperative that surgical teams and their leaders identify risk factors for RSIs and make every effort to minimize those risks. Weprin et al. (2021) reported that common causes for RSIs are communication failures, lack of adaptability, and distractions. Standardizing procedures and reports can accommodate surgical staff by reinforcing the ease and importance of accurately reporting every event. Multitasking during counts should be curtailed, and the OR environment should be kept quiet until counts are completed. Implementing new technologies to augment

manual counting is warranted (Weprin et al., 2021). This problem is multifactorial and complex, meaning prevention will rely on the entire team and require a systems-based solution. And, even so, human imperfections and errors will continue to be present, necessitating assistive technologies. Finding solutions to prevent RSIs during surgery should be a proactive shift rather than a reactive approach to these medical errors.

The evidence-based educational intervention was created based on AORN standards, thus contributing to improved preventative strategies to reduce the incidence of RSI events. Root causes, specific surgical events, appraisal of details, precise causation, and contributing risk factors can be gleaned from the literature to explore the etiology of RSIs. Examination of existing data can reveal numerous design flaws, such as limitations of generalizability, interpretation of the data, and the threat of internal and external validity; establishing a cause-and-effect relationship may be limited (Ross & Zaidi, 2019).

Future research opportunities and associated imperatives should proceed with investigative contributions to healthcare science through significant discoveries and the advancement of team competencies (Rosen et al., 2018). Healthcare team performance as influenced by organizational leadership external to health teams and the role of culture is the focus of research to date. The influence of team performance by organizational leaders is viewed as a step toward transitioning to an accountable care organization (Rosen et al., 2018). For teams to achieve their high expectations, it is important for them to understand that healthcare leaders can support team success by creating appropriate and incentive-rich environments.

Within healthcare work teams, there are subsets of varied disciplinary mixes and specialties that contribute to the success of teams (Rosen et al., 2018). It is incumbent upon organizational leaders to know what conditions inspire healthcare teams to be productive,

function effectively, and deliver the best patient care. A culture of interdependency, facilitation of team development, and inclusion of teams in decisions that impact them are other ways for healthcare leaders to influence teams (Rosen et al., 2018). These tightly intertwined concepts in practice corroborate how the interactions of team members are shaped and how teams function; hence, collective perceptions of priorities and values create their own microculture (Rosen et al., 2018). Domestic estimates for RSIs would be more accurate if perioperative communities were provided with data based on a national reporting system.

Interpretation and Inference of the Findings

The DNP essentials outline foundational competencies as being core to advanced nursing practice. The American Association of Nursing (AACN) defines curricular elements required for DNP practice-focused programs, including safe nursing practice to enhance patient care delivery and positive outcomes (Moran et al., 2020). Projects conducted by doctoral students are required to enhance and evaluate practice outcomes, health outcomes, or policy outcomes (Moran et al., 2020). They must also engage in new collaborative partnerships, carefully deliberate the pinnacle of inquiry, and reflect on the translation of research into practice. Practice-focused doctoral programs equip DNP graduates to bridge the gap between new science and integration into practice (Moran et al., 2020). It is imperative that students create projects that incorporate research into clinical practices to enhance health outcomes and advance the nursing profession.

Essentials of Doctoral Education for Advanced Practice Nurses

Essential I: Scientific Underpinnings for Practice

Essential I was embedded within the project as a scientific approach to guide advanced nursing practice. Science-based concepts and sound theory are integral to enhancing health outcomes and elevating healthcare delivery. The significance of utilizing evidence-based

concepts to improve patient outcomes is underscored by this essential. Ineffective communication and defective counting practices have been identified as primary contributors to the avoidable error of RSI (Weprin et al., 2021). Knowles' adult learning theory (andragogy) provided the learning framework for the study by promoting effective communication and standardized work processes.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

This essential promoted principles of practice management, proficiency in practical quality strategies to improve and sustain organizational changes at policy levels, and managing emerging practice problems and ethical dilemmas (Moran et al., 2020). Findings from the investigator's safety project substantiated that the educational intervention equipped OR participants (RNs and STs) with increased knowledge and enhanced self-efficacy overall as related to preventing unintentional RSIs. This essential was introduced during the safety project as a quality initiative to foster OR teams' accountability and enhance patient-centric care delivery. The educational intervention was evidence-based and designed to promote standardized counting procedures and the delivery of quality patient care. Leadership is the core role of advanced practice and is viewed as an inherent quality of DNPs. Study findings rendered information that correlated with positive patient outcomes within the surgical environment, which were strongly dependent upon accurate and complete communication and hardwired standardization of surgical counting procedures (Weprin et al., 2021).

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

This essential was embedded within the theory, design, methodology, data acquisition, and analysis of this project, ultimately producing a science-based intervention to aid in

preventing harm to patients during surgery. Clinical scholarship acknowledged enhancing clinical competencies and refinement of communication techniques through focused education and training. This essential equips the DNP with systems-level thinking for integrating complex healthcare issues with accountability for safe care delivery (Moran et al., 2020). Advanced education provides knowledge that improves theoretical foundations and the practice of nursing. Best current practice and acquired knowledge were translated into clinical practice (Moran et al., 2020). This body of work chronicles a comprehensive manuscript based on systems thinking that focuses on change for healthcare improvement. Counting practices in the OR have traditionally been periodically unreliable, therefore creating the need for meaningful changes in surgical practice (Gibbs & Romano, 2024).

Essential IV: Information Systems and Technology and Patient Care Technology for the Improvement and Transformation of Health Care

Application of this essential was relevant for delivering consent, the educational intervention program, pretest and posttest surveys, and program evaluations to study participants. Information systems helped to facilitate enhanced care delivery by minimizing unanticipated errors induced by human factors. For example, imprecise recommended dosing levels of medications, indecipherable handwriting, and disregard for safety regulations contribute to common medical inaccuracies (Academy of Managed Care Pharmacy, 2019). Technology reduces the burden of astronomical healthcare costs and promotes effective healthcare management. Information systems elevate DNP practitioners to a higher level, enabling them to "see" patient safety through the lens of digital health. Facilitating open communication and nursing accountability can be supported by superior technological applications and clinical

decision-making (Moran et al., 2020). This DNP essential interfaces with technological applications for further improvement of the nursing profession.

Essential V: Health Care Policy for Advocacy in Health Care

The safety project was designed to prevent accidental RSIs during surgery while advocating for safe surgical procedures. This particular sentinel event goes underreported and underestimated, thus it is a phenomenon that policymakers must address to establish policy mandates and laws to protect patients in the OR from significant harm. This essential lays the foundation for policymakers to promote and protect the health of patients and their communities by determining fundamental goals, decisions, and actions (Moran et al., 2020). Active engagement of the DNP at all levels of health policy aligns with this essential by influencing the care of the populations within the health sector. Their involvement is imperative for identifying clinical shortcomings that present challenges for healthcare teams in compromising safe patient care. Development of recommendations should include increased adherence to best practice and evidence-based care.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

The project acknowledged this essential by preparing the DNP to lead collaborative teams in complex, multitier care environments. This essential focused on promoting collaborative skills and effective communication, which demonstrates that DNPs understand the concept of interprofessional collaboration. Team-based patient care addressed this essential by employing evidence-based leadership competencies when cooperating and participating with teams. Benefits associated with collaborative practice include comprehensive healthcare services, reduced costs, and enhanced efficiency (Goldsberry, 2018). Through efforts of

collaborative partnerships, DNP practitioners may find themselves as learners seeking distinct opportunities to advocate for the best clinical outcomes.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

Reduction and prevention of operative RSI errors addressed this essential by promoting a safety culture. At the forefront of this essential lies risk reduction and illness prevention among individuals and communities. Preventive strategies that promote healthy lifestyles and advocate for safety measures in the OR ensure EBP. This essential is founded in preparing DNP graduates to efficiently examine and define occupational, epidemiological, environmental, and biostatistical data critical to advancing the health of individuals and communities (Moran et al., 2020).

Essential VIII: Advanced Nursing Practice

This essential is grounded in strong clinical knowledge and judgment in relation to distinguishing risk-reduction strategies in the OR. To improve patient outcomes, the DNP nurse must demonstrate the best in clinical decision-making, evidence-based care delivery, and systems thinking. Essential VIII delineates key components of the study manuscript that include empowering DNP graduates to enhance the quality of care, reduce healthcare disparities, employ advanced levels of clinical judgment, promote optimal care, systematically translate best evidence into practice, and strategize for sustainability (Moran et al., 2020). Innovative leadership, global thinking, and ethical practice are emphasized to bridge the boundaries of shared goals, common visions, and diverse expertise of colleagues to lead visionary changes in healthcare.

Conclusion

Effective communication and transparency among team members are essential for reducing errors in the operative suite. In terms of systematic procedural steps, verifiable practices should include standardized manual counting and count reconciliation, methodical sweep of the wound by the surgeon, radiological imaging to verify RSI, and the use of adjunct technology (Fogle, 2023). A comprehensive approach to implementing EBP requires the involvement of every team member: RN nurse circulator, ST or scrub nurse, first assistant, surgeon(s), and anesthesia provider. Many organizations continue to rely solely on manual counting as the primary safeguard for preventing RSIs. The most recent recommendation by the AORN and supporting evidence from the literature clearly recommend the use of adjunct technology systems in concert with the manual counting process (Fogle, 2023). Technologies are not meant to replace counting protocols but rather designed to enhance the process (Fogle, 2023).

Pain, suffering, and subsequent surgeries are typically implicated for the victims of RSIs, and additional negative consequences involve repercussions for the surgeon and healthcare organization (Fogle, 2023). Significant public relations and financial impacts may result from harm to the reputation of the surgeon and organization, threat of litigation, and increased costs of care. Total costs of care related to an RSI event have been estimated at $166,000 to $600,000 per event, which includes the surgical expenditures not paid by CMS, indemnity payments, and legal defense for the organization (Primiano et al., 2020). Public reporting for adverse patient events is mandatory and may attract widespread coverage by the press, further tarnishing the image of the organization or hospital system.

All reasonable strategies should be exercised by organizations to avoid the retention of unintentional RSIs within the surgical wound. Consistent application of reliable and systematic

processes of care in the operating suite is essential. Healthcare professionals share a common moral, ethical, and legal responsibility to promote optimal outcomes for patients. Surgical team members should be urged to adhere to the same prescriptive process for the counting method to ensure the elimination of potential errors that can cause harm to surgical patients (Stucky et al., 2024). Prevention is the most effective approach to minimizing or eradicating the risk of RSI occurrences. The goal of zero RSIs is a lofty one and likely associated with obstacles, but educational programs that outline and emphasize correct protocol and procedures would help to eliminate surgical errors.

References

Academy of Managed Care Pharmacy. (2019, July). *Medication errors*. https://www.amcp.org/concepts-managed-care-pharmacy/medication-errors

Andreev, I. (2023). *Analytics: The Kirkpatrick model*. Valamis. https://www.valamis.com/hub/kirkpatrick-model

Association of periOperative Registered Nurses. (2016, April). Guideline updates focus on counting, communication to prevent RSIs. *Patient Safety Monitor Journal*, *17*(4) 10–11. https://www.proquest.com/docview/1771600285?sourcetype=Trade%20Journals

Association of periOperative Registered Nurses. (2019, July). AORN position statement on perioperative registered nurse circulator dedicated to every patient undergoing an operative or other invasive procedure. *AORN Journal*, *110*(1), 82–85. https://aornjournal.onlinelibrary.wiley.com/doi/10.1002/aorn.12741

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Biao, I. (2021). Benin: Governance, lifelong learning and development. *Journal of Adult and Continuing Education*, *28*(2), 540–557. https://doi.org/10.1177/1477971421999411

Bhandari, P. (2023, June). *What is quantitative research? Definition, uses & methods*. Scribbr. https://www.scribbr.com/methodology/quantitative-research/

Bolton, R., Logan, C., & Gittell, J. H. (2021). Revisiting relational coordination: A systematic review. *Journal of Applied Behavioral Science*, *57*(3), 290–322. https://doi.org/10.1177/0021886321991597

Bouchrika, I. (2024). *The andragogy approach: Knowles' adult learning theory principles in 2024*. Research.com. https://www.guide2research.com/research/the-andragogy-approach#1

Cima, R. R., Kollengode, A., Garnatz, J., Storsveen, A., Weisbrod, C., & Deschamps, C. (2008, July). Incidence and characteristics of potential and actual retained foreign object events in surgical patients. *Journal of the American College of Surgeons*, *207*(1), 80–87. https://pubmed.ncbi.nlm.nih.gov/18589366/

Cochran, K. (2022, November). Guidelines in practice: Prevention of unintentionally retained surgical items. *AORN Journal*, *116*(5), 427–440. https://doi.org/10.1002/aorn.13804

Conley, D. M., Singer, S. J., Edmondson, L., Berry, W. R., & Gawande, A. A. (2011, May). Effective surgical safety checklist implementation. *Journal of the American College of Surgeons*, *212*(5), 873–879. https://pubmed.ncbi.nlm.nih.gov/21398154/

Crawford, C. L., Rondinelli, J., Zuniga, S., Valdez, R. M., Cullen, L., Harahan, K., & Titler, M. G. (2020, April). Testing of the nursing evidence-based practice survey. *Worldviews on Evidence-Based Nursing*, *17*(2), 118–128. https://doi.org/10.1111/wvn.12432

Davoodvand, S., Abbaszadeh, A., & Ahmadi, F. (2016). Patient advocacy from the clinical nurses' viewpoint: A qualitative study. *Journal of Medical Ethics and History of Medicine*, *9*(5), 1–8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4958925/

DeWane, M. P., & Kaafarani, H. M. A. (2023, January). Retained surgical items: How do we get to zero? *Joint Commission Journal on Quality and Patient Safety*, *49*(1), 1–2. https://www.jointcommissionjournal.com/article/S1553-7250(22)00270-7/fulltext

Fencl, J. L. (2016, July). Guideline implementation: Prevention of retained surgical items. *AORN Journal*, *104*(1), 37–48. https://doi.org/10.1016/j.aorn.2016.05.005

Flanagan, M. (2019). Retained surgical items (RSI). *Journal of Legal Nurse Consulting*, *30*(1), 34–37. https://www.aalnc.org/Portals/0/Docs/Archives/Spring%202019.pdf?ver=b-k6xcjL8cT8stKPQYDmRA%3d%3d

Fogle, L. (2023, February). *What are retained surgical items?* Steris Healthcare. https://www.steris.com/healthcare/knowledge-center/surgical-equipment/retained-surgical-items

Gawande, A. A., Studdert, D. M., Orav, E. J., Brennan, T. A., & Zinner, M. J. (2003, January). Risk factors for retained instruments and sponges after surgery. *New England Journal of Medicine*, *348*(3), 229–235. https://doi.org/10.1056/NEJMsa021721

Gibbs, V. C. (2011, July). Retained surgical items and minimally invasive surgery. *World Journal of Surgery*, *35*(7), 1532–1539. https://doi.org/10.1007/s00268-011-1060-4

Gibbs, V. C. (2012). Thinking in three's: Changing surgical patient safety practices in the complex modern operation room. *World Journal of Gastroenterology*, *18*(46), 6712–6719. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3520159/

Gibbs, V. C., Coakley, R. D., & Reines, H. D. (2007, May). Preventable errors in the operating room: Retained foreign bodies after surgery. *Current Problems in Surgery*, *44*(5), 281–337. https://www.sciencedirect.com/science/article/abs/pii/S0011384007000317

Gibbs, V. C., & Romano, P. (2024, January). *Retained surgical items: Definition and epidemiology*. Department of Health and Human Services, Agency for Healthcare Research and Quality, Patient Safety Network. https://psnet.ahrq.gov/primer/retained-surgical-items-definition-and-epidemiology

Goldsberry, J. W. (2018, June). Advanced practice nurses leading the way: Interprofessional collaboration. *Nurse Education Today*, *65*, 1–3. https://doi.org/10.1016/j.nedt.2018.02.024

Goodwin, B. (2018, March). Retained surgical item lawsuits will cost you. *Urology Times: Malpractice Consult, 3,* 46. https://www.urologytimes.com/view/retained-surgical-item-lawsuits-will-cost-you

Greenberg, C. C., Regenbogen, S. E., Lipsitz, S. R., Diaz-Flores, R., & Gawande, A. A. (2008, August). The frequency and significance of discrepancies in the surgical count. *Annals of Surgery*, *248*(2), 337–341. https://doi.org/10.1097/SLA.0b013e318181c9a3

Gunnar, W., Soncrant, C., Lynn, M. M., Neily, J., Tesema, Y., & Nylander, W. (2020, December). The impact of surgical count technology on retained surgical items rates in the Veteran's Health Administration. *Journal of Patient Safety*, *16*(4), 255–258. https://pubmed.ncbi.nlm.nih.gov/32217934/

Heydari, M. R., Taghva, F., Amini, M., & Delavari, S. (2019, July). Using Kirkpatrick's model to measure the effect of a new teaching and learning methods workshop for health care staff. *BMC Research Notes*, *12*(Article 388), 1–5. https://doi.org/10.1186/s13104-019-4421-y

Hempel, S., Maggard-Gibbons, M., Nguyen, D. K., Dawes, A. J., Miake-Lye, I., Beroes, J. M., Booth, M. J., Miles, J. N. V., Shanman, R., & Shekelle, P. G. (2015, August). Wrong-site surgery, retained surgical items, and surgical fires: A systematic review of surgical never events. *Journal of American Medical Association Surgery*, *150*(8), 796–805. https://pubmed.ncbi.nlm.nih.gov/26061125/

Joint Commission (2023). *Sentinel event data 2022 annual review*. https://www.jointcommission.org/resources/news-and-multimedia/news/2023/04/the-joint-commission-releases-sentinel-event-data/

Kertesz, L., Cordella, C. M., Nadera, N. M., Nelson, P. E., Kahil, M., Shim, S.-H., & Holtzman, J. S. (2020, March). No surgical items left behind: A multidisciplinary approach to the surgical count process. *Journal of Radiology Nursing*, *39*(1), 57–62. https://www.sciencedirect.com/science/article/abs/pii/S154608431930166X?via%3Dihub

Knowles, M. (2018, July). *13 statistics on never events*. Becker's Clinical Leadership. https://www.beckershospitalreview.com/quality/13-statistics-on-never-events.html

Koek, A. Y. (2020, January). Retained surgical sponge presenting four decades later as a rapidly growing soft tissue mass. *Case Reports in Surgery*, *2020*(Article 1230173), 1–3. https://doi.org/10.1155/2020/1230173

Kurt, S. (2016, October). *Kirkpatrick model: Four levels of learning evaluation*. Educational Technology. https://educationaltechnology.net/kirkpatrick-model-four-levels-learning-evaluation/

Kurt, S. (2020, June). *Andragogy theory—Malcolm Knowles*. Educational Technology. https://educationaltechnology.net/andragogy-theory-malcolm-knowles/

Kusuda, K., Yamashita, K., Tanaka, S., Tanaka, S., & Ohta, Y. (2020). Development of a surgical sponge counting system using radiographic images. *Surgical Innovation*, *27*(6), 647–652. https://doi.org/10.1177/1553350620943349

Landers, R. (2015, June). Reducing surgical errors: Implementing a three-hinge approach to success. *AORN Journal*, *101*(6), 657–665. https://doi.org/10.1016/j.aorn.2015.04.013

Lee, H., Woodward-Kron, R., Merry, A., & Weller, J. (2023). Emotions and team communication in the operating room: A scoping review. *Medical Education Online*, *28*(1), 1–14. https://doi.org/10.1080/10872981.2023.2194508

Littell, J. H. (2024). The logic of generalization from systematic reviews and meta-analyses of impact evaluations. *Evaluation Review*, *48*(3), 427–460. https://doi.org/10.1177/0193841x241227481

Loeng, S. (2018). Various ways of understanding the concept of andragogy. *Cogent Education*, *5*(1), 1–15. https://doi.org/10.1080/2331186X.2018.1496643

Merraine Group. (2023). *Disruptive operating room technology in 2023*. Merraine Group, Inc. https://www.merraine.com>disruptive-operating-room-in-technology

Middleton, F. (2023, June). *Reliability vs. validity in research. Difference, types and examples*. Scribbr. https://www.scribbr.com/methodology/reliability-vs-validity/

Moorehead, L. D. (2023, April). The high cost of retained surgical items. *Outpatient Surgery: A Division of AORN*, 1–5. https://www.aorn.org/outpatient-surgery/article/the-high-cost-of-retained-surgical-items

Moran, K., Burson, R., & Conrad, D. (2020). *The doctor of nursing practice project: A framework for success* (3rd ed.). Jones & Bartlett Learning.

Mukhalalati, B. A., & Taylor, A. (2019). Adult learning theories in context: A quick guide for healthcare professional educators. *Journal of Medical Education and Curricular Development*, *6*, 1–10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6458658/

Pallant, J. (2020). *SPSS survival manual* (7th ed.). McGraw-Hill Open University Press.

Patra, K. P., & De Jesus, O. (2022). *Sentinel event*. StatPearls Publishing.

Primiano, M., Sparks, D., Murphy, J., Glaser, K., & McNett, M. (2020, October). Using radiofrequency technology to prevent retained surgical sponges and improve patient outcomes. *AORN Journal*, *112*(4), 345–352. https://doi.org/10.1002/aorn.13171

Pyrek, K. M. (2022, August). Preventing retained surgical objects: Using best practices, adjunct technology. *Healthcare Hygiene Magazine*, 1–17. https://www.healthcarehygienemagazine.com/preventing-retained-surgical-objects-using-best-practices-adjunct-technology/

Reddy, A., Mahajan, R., Rustagi, T., Goel, S. A., Bansal, M. L., & Chhabra, H. S. (2019). A new search algorithm for reducing the incidence of missing cottonoids in the operating theater. *Asian Spine Journal*, *13*(1), 1–6. https://doi.org/10.31616/asj.2018.0136

Rosen, M. A., DiazGranados, D., Dietz, A. S., Benishek, L. E., Thompson, D., Pronovost, P. J., & Weaver, S. J. (2018). Teamwork in healthcare: Key discoveries enabling safer, high-quality care. *American Psychology*, *73*(4), 433–450. https://doi.org/10.1037/amp0000298

Ross, P. T., & Zaidi, N. L. B. (2019, August). Limited by our limitations. *Perspectives on Medical Education*, *8*(4), 261–264. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6684501/

Santos, G., & Jones, M. W. (2023, May). *Prevention of surgical errors*. StatPearls Publishing.

Sirihorachai, R., Saylor, K. M., & Manojlovich, M. (2022, February). Interventions for the prevention of retained surgical items: A systematic review. *World Journal of Surgery*, *46*(2), 370–381. https://doi.org/10.1007/s00268-021-06370-3

Steelman, V. M., Shaw, C., Shine, L., & Hardy-Fairbanks (2018). Retained surgical sponges: A descriptive study of 319 occurrences and contributing factors from 2012 to 2017. *Patient Safety in Surgery*, *12*(20), 1–8. https://doi.org/10.1186/s13037-018-0166-0

Stratton, S. J. (2019, November). Quasi-experimental design (pre-test and post-test studies) in prehospital and disaster research. *Prehospital and Disaster Medicine*, *34*(6), 573–574. https://doi.org/10.1017/S1049023X19005053

Stucky, C. H., Hartmann, J. M., Yauger, Y. J., Romito, K. J., Bradley, D. F., Baza, G., Lorenz, M. E., House, S. L., Dindinger, R. A., Wymer, J. A., Miller, M. J., & Knight, A. R. (2024, February). Surgical safety does not happen by accident: Learning from perioperative near miss case studies. *Journal of Perianesthesia Nursing*, *39*(1), 10–15. https://pubmed.ncbi.nlm.nih.gov/37855761/

Styskel, B., Wernick, B., Mubang, R., Falowski, S., Papadimos, T., & Stawicki, S. (2016). Retained surgical items: Building on cumulative experience. *International Journal of Academic Medicine*, *2*(1), 5–21. https://doi.org/10.4103/2455-5568.183316

Susmallian, S., Barnea, R., Azaria, B., & Szyper-Kravitz, M. (2022). Addressing the important error of missing surgical items in an operated patient. *Israel Journal of Health Policy Research*, *11*(19), 1–10. https://doi.org/10.1186/s13584-022-00530-z

Thompson, D., Leach, M., Smith, C., Fereday, J., & May, E. (2020, March). How nurses and other health professionals use learning principles in parent education practice: A scoping review of the literature. *Heliyon*, *6*(3), 1–24. https://www.cell.com/action/showPdf?pii=S2405-8440%2820%2930409-6

Tørring, B., Gittell, J. H., Laursen, M., Rasmussen, B. S., & Sørensen, E. E. (2019). Communication and relationship dynamics in surgical teams in the operating room: An ethnographic study. *BMC Health Services Research*, *19*(Article 528), 1–16. https://doi.org/10.1186/s12913-019-4362-0

Tucker, S., & Melnyk, B. M. (2019, June). A leader's guide to implementing evidence-based practice: Lead the way to healthcare quality and safety. *American Nurse Today*, *14*(6), 6–9. https://www.myamericannurse.com/leaders-guide-implementing-evidence-based-practice/

Wallace, S. C. (2017, March). Retained surgical items: Events and guidelines revisited. *Pennsylvania Patient Safety Advisory*, *14*(1), 27–35. https://patientsafety.pa.gov/ADVISORIES/Pages/201703_RSI.aspx

Weprin, S., Crocerossa, F., Meyer, D., Maddra, K., Valancy, D., Osardu, R., Kang, H. S., Moore, R. H., Carbonara, U., Kim, F. J., & Autorino, R. (2021, July). Risk factors and preventive strategies for unintentionally retained surgical sharps: A systematic review. *Patient Safety in Surgery*, *15*(Article 24), 1–10. https://doi.org/10.1186/s13037-021-00297-3

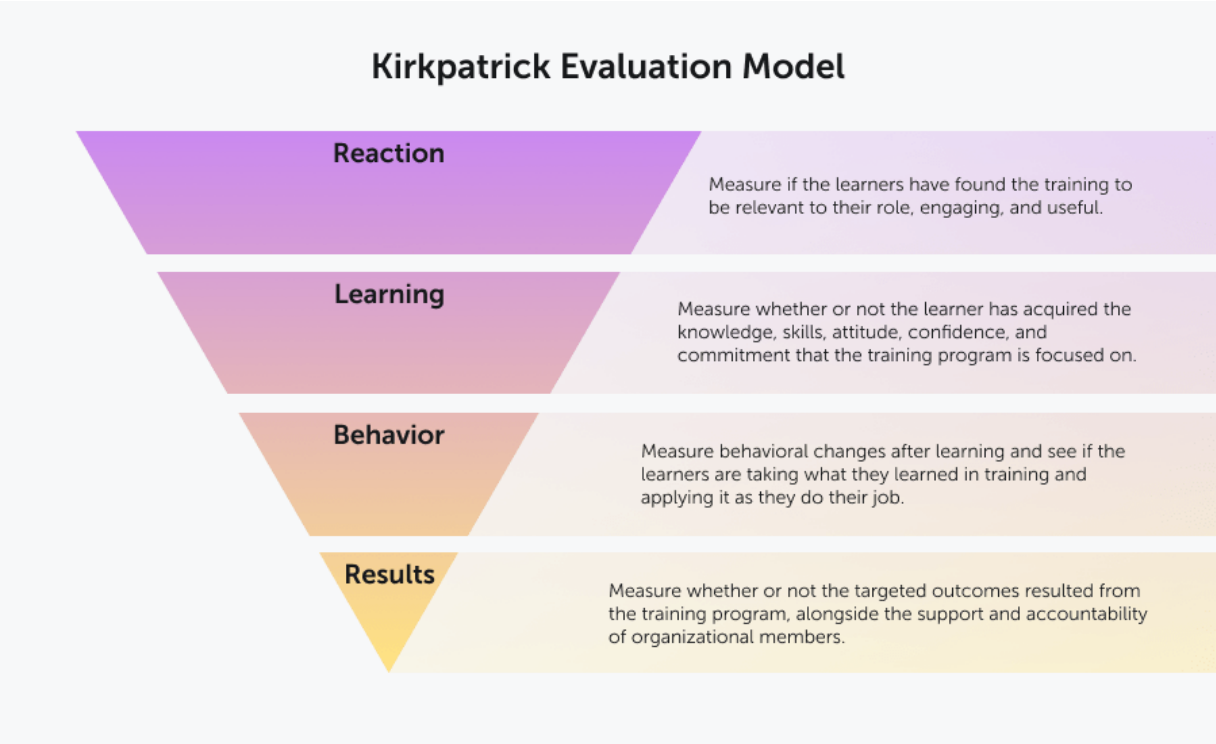
Zarenezhad, M., Gholamzadeh, S., Hedjazi, A., Soltani, K., Gharehdaghi, J., Ghadipasha, M., Hosseini, S. M. V., & Zare, A. (2017, March). Three years evaluation of retained foreign bodies after surgery in Iran. *Annals of Medicine and Surgery*, *15*, 22–25. https://doi.org/10.1016/j.amsu.2017.01.019

Zejnullahu, V. A., Bicaj, B. X., Zejnullahu, V. A., & Hamza, A. R. (2017, May). Retained surgical foreign bodies after surgery. *Journal of Medical Sciences*, *5*(1), 97–100. https://doi.org/10.3889/oamjms.2017.005

Ziman, R., Espin, S., Grant, R. E., & Kitto, S. (2018, September). Looking beyond the checklist: An ethnography of interprofessional operating room safety cultures. *Journal of Interprofessional Care*, *32*(5) 575–583. https://www.tandfonline.com/doi/full/10.1080/13561820.2018.1459514

Appendix A: Kirkpatrick Four-Stage Model

The Kirkpatrick Model Training Evaluation: Guide



Note. From *Analytics: The Kirkpatrick Model*, by I. Andreev, 2023 (https://www.valamis.com/hub/kirkpatrick-model). In the public domain.

Appendix B: Intervention—Educational Program

EDUCATIONAL PROGRAM

Perioperative Safety Project to Prevent Unintentional Retained Surgical Items

Introduction

Safety culture characterizes a collection of values, competencies, and patterns of behavior that describe an organization's commitment to safety management (Ziman et al., 2018).

Unintentional retained surgical item (RSI) is identified as any foreign object that is left inside a patient during surgery or an invasive procedure. Potential consequences after surgery of a foreign body may manifest in various forms, either immediately after surgery, weeks, months, or even years later, resulting in devastating harm or death (Weprin et al., 2021). Prevention of RSI events requires a systems-based solution, albeit imperfections and human error are always present.

Employing transparent, standardized, reliable, and verifiable practices during an invasive procedure to account for surgical items used falls to the responsibility of healthcare organizations (Pyrek, 2022). According to Weprin et al. (2021), risk factors highly associated with RSI events include incorrect counts, lack of surgical counts (emergent cases), prolonged operative time, blood loss greater than 500cc, unexpected intraoperative findings, more than one subprocedure, increased body mass index (BMI), and more than one surgical team. Despite the increased focus on RSI events, vulnerability remains. Correct counts do not necessarily mean there is no retained item in the patient. Moreover, unintentional RSI is the MOST common sentinel event reported in the OR, according to The Joint Commission (2023).

Communication

The *Theory of Relational Coordination* suggests that relationships of shared knowledge and goals and mutual respect support timely, accurate, frequent, and problem-solving communication (Bolton et al., 2021). Increasingly specialized, complex work in the operating room demands relational coordination across disciplines and roles to achieve desired patient outcomes. Dysfunctional, fragmented relationships will not enable efficiency and coordination of work across roles. Heightened awareness and optimizing desired outcomes rely on strong, cohesive relationships. Outcomes that include increased efficiency, improved worker well-being, improved quality, and increased innovation and learning are driven by relational coordination. It is the core construct of the theory and is defined as "a mutually reinforcing process of communicating and relating" for the purpose of completing a shared task (Bolton et al., 2021, p. 293).

Self-Efficacy or Confidence

Self-efficacy represents an individual's perception of one's capacity to execute essential behaviors that produce the achievement of a specific performance (Bandura, 1997). The self-

efficacy theory (SET) developed by the psychologist Albert Bandura has been considerably influential on clinical practice, education, and research. The ability to exercise control of one's own behavior, motivation, and social environment is reflected in self-efficacy. Bandura (1997) was a compelling proponent of the self-efficacy theory and defined the theorem as having a sense of control over one's behavior and environment. This social cognitive theory incorporates beliefs that are foundational to human behavior, according to its creator, Bandura. In other words, the idea of believing in the concept of being successful is that one can succeed in a particular situation (Bandura, 1997).

Components of Educational Offering

• Define the objectives of this educational program and the details of informed consent. *Informed Consent* is a form of communication used mostly between a patient and healthcare provider that documents permission for care, explains the risks and benefits of the treatment, and offers alternate options. The primary purpose of informed consent is to protect the patient. The consent process can also pertain to a researcher seeking permission from a potential participant in a study.

• Initial knowledge and self-efficacy assessment (pretest survey).

• The scope of retained surgical items, patient, and organizational consequences.

View video by Dr. Verna Gibbs, surgeon who developed "NoThing Left Behind®". The YouTube video is entitled Patient Safety First—Dr. Gibbs and Sponge Accounting System: https://www.youtube.com/watch?v=44SFY_nodrQ. The program advocates for all OR personnel to be accountable for counting every item.

• Review the *Association of periOperative Registered* Nurses (AORN) guidelines and standards of practice.

NOTE: Evidence-based recommendations designate AORN guidelines for perioperative practice as the gold standard for delivering safe perioperative care and achieving workplace safety.

• The identification of unintentional retained surgical items, causative factors, and appropriate level of intervention.

• Explore existing counting practices and need for improvement or change. Introduce literature recommendations and timeframe target date for change.

• Provide RSI education and training for OR nurses and STs that includes steps for conducting surgical counts while simultaneously documenting counts on the whiteboard in the OR.

• Discuss various adjunct technologies as detection systems that can be used in concert with manual counting, including the use of <u>only</u> radiopaque items in surgery.

• Introduction of tools and pathways to facilitate quality care and standardization.

• Emphasize collaborative teamwork and effective communication skills reinforced through educational methods to indoctrinate OR team members with techniques to manage productive dialogue. Effective team communication should largely focus on strategies to improve information transfer with less focus on emotional aspects of communication and interpersonal dynamics (Lee et al., 2023). Essential strategies to enhance communication in the OR include closed-loop communication, briefings, and techniques to encourage all staff to speak up if something does not feel right.

The OR is a highly emotional environment that requires exceptional team communication. As a group, try to identify emotional triggers that hinder or influence clear, succinct communication and how to manage those emotions. When negative emotional behaviors are demonstrated in the OR, one's tone of voice, use of repetition or emphasis, and nonverbal cues can indicate signs of tension. Consequences of emotions include not only ineffective communication but fractured team dynamics and produce potentially negative impacts on patient care (Lee et al., 2023).

Stress is easily generated in the OR and can be caused by time pressure, emergency cases, equipment problems, interpersonal issues between team members, and unexpected surgical complications. One strategy to help with the stress is to simply pause and stand back momentarily to reassess the situation, quickly determine options, make a decision, then plan and prepare for the next stage (Lee et al., 2023). This instruction will empower staff members and enable them to boost self-confidence and self-efficacy. Create a safety culture with positivity and disallow disruptive behavior by staff and physicians.

This culture change may lead to increased quality of communication, improved perception of team communication, improved transfer of information, improved ability to speak up with concerns, and more enhanced and structured communications for the handover of patient information. Additional strategies to employ are relationship management techniques (learn to gauge others' emotional responses), recalibrate own actions (based on what you learn), rapport and team building, and seeking out social support to navigate the conflicts (Lee et al., 2023).

• Introduce organization's benchmarking tools for quality review and tracking; share surgical *Key Performance Indicators* (KPIs) for organization.

• Final knowledge and self-efficacy assessment (posttest survey).

Program Learning Objectives

1. Standardize communication and dismantle hierarchical barriers to create a culture and environment that promotes patient safety in the OR.

2. Master minimization of distractions or unnecessary interruptions in the OR to ensure full attention is given to accurate counting procedures. This includes loud music, telephone calls, disorderly, boisterous conversations, visitors to the operating room, etc.

3. Utilize best practice methods for counting while maintaining consistent and coordinated guidelines.

4. Follow appropriate *proximal to distal* sequence of counting that includes surgical field, Mayo stand, back table, and discarded soft goods in the kick bucket.

5. Increase awareness of OR personnel, particularly STs, to carefully inspect instruments and equipment for fragmentation or signs of damage.

6. Distinguish between *sentinel events* and *near misses* as related to the counting process and RSI events *(See Glossary)*.

7. Identify own individual role in the operating suite and personal accountability to the team.

8. Utilization of adjunct technologies to assist with manual counting in the OR.
These may include Sponge ACCOUNTing System, radiofrequency (RF) detection system, radiofrequency identification system (RFID), bar-coding system, and computer-assisted sponge count system. Depending upon the technology selected to evaluate, healthcare organizations can determine the most suitable device for implementation to meet their needs. Use of technology devices is not meant to replace manual counting but is intended to augment the process.

Education Agenda

1. Review objectives of educational offering.

2. Administer (20-question) pretest to volunteer participants (N = 10—RNs and STs).

3. Introduce structured educational curriculum and team training.

4. Provide explanations for:

- *Retained surgical item (RSI)*: Any item that is foreign left inside the patient during surgery or invasive procedure and may manifest its presence in various forms, causing complications for the patient. Systems sometimes fail resulting in retained bodies left in the unsuspecting patient (Zejnullahu et al., 2017).

- Common operational definitions: *See Glossary*.

- When counts should be done—Surgical counts should occur:

    a. Before the procedure begins.
    b. When new items are added to the sterile field: Count in multiples of "10."
    c. When either the RN circulator or ST is relieved.
    d. When a count discrepancy is suspected.
    e. Before a cavity within a cavity is closed.
    f. When the closure of the wound begins.

g. When the final count is performed.

- Effective communication based on the *Theory of Relational Coordination*
  **See page 1 segment on *Communication*

- Self-efficacy based on *Bandura's self-efficacy theory*
  **See page 2 segment on *Self-Efficacy*

5. View video: *The Surgical Count* (15 minutes) at website https://www.operatingroomissues.org/surgical-counts-2/

6. Provide explanations and review:
- Your organization's current surgical counting practices.
- Appropriate standardized surgical count.
- Relevant AORN Guidelines and Standards for prevention of RSIs.
- The Joint Commission (TJC) Guidelines and Operating Room Standards.
- Centers for Medicare and Medicaid Services (CMS) Guidelines for prevention of RSIs.

7. View video by Dr. Verna Gibbs, surgeon who developed "NoThing Left Behind®". The YouTube video is entitled Patient Safety First—Dr. Gibbs and Sponge Accounting System: https://www.youtube.com/watch?v=44SFY_nodrQ.

The program advocates for all OR personnel to be accountable for counting every item (30 minutes in length). In this video, Dr. Gibbs only addressed counting techniques of raytex and laparotomy pads, omitting other surgical supplies. Consequently, studies have shown that sponges are the most common unintentional retained item (Pyrek, 2022).

8. Questions and Answers.

9. Administer posttest (identical to pretest with some variation of questions) to the same OR personnel and comparative analysis will be used to calculate scores. Findings will substantiate whether or not OR personnel can increase their knowledge regarding prevention of RSIs and enhance a strong sense of self-efficacy resulting from the educational program.

10. Participants complete overall evaluation form for educational program.

Glossary: Operational Definitions

Adjunct technologies: Technology devices are used in concert with manual counting to potentially reduce the risk of RSIs and decrease count discrepancies in the operating room (Pyrek, 2022).

Closing count (final): A count conducted at the completion of the procedure but before the surgeon has completely closed the incision (Greenberg et al., 2008).

Devices: Catheters, drains, and guidewires are devices used in surgery (Wallace, 2017).

Discrepancy: Any instance during a surgical case in which the subsequent count is different from the previous one (Greenberg et al., 2008). Discrepant counts may be the result of improper management systems, fatigue, or inexperience with surgical emergencies (Cochran, 2022).

Effective team communication: Communication of relevant information with dialogue that is conveyed effectively and received accurately (Tørring et al., 2019).

Gossypiboma: Surgical sponge inadvertently left inside a patient during a surgical or invasive procedure (AORN, 2016). Fogle (2023) reported that surgical sponges account for the majority of RSIs (64%–70%).

Initial Count (opening): Count that occurs before the procedure begins (Greenberg et al., 2008).

Interim counts: Counts conducted throughout the case per OR protocol and at the discretion of the surgical team, such as handoffs for lunch relief or shift change (Greenberg et al., 2008).
Instruments: In this study, whole surgical instruments such as scissors, forceps, and retractors (Wallace, 2017).

Laparotomy pad: Abdominal pad or laparotomy sponge is an absorbent pad used by surgeons during surgical procedures to maintain visualization of the surgical region by keeping the area free of blood, excessive body fluids, and other liquids (Steelman et al., 2018).

Miscellaneous items: In this study, intact items, including drill bits, screws, vessel loops, nails, cautery tips, and wing nuts (Wallace, 2017).

Miscount: Discrepancy occurs in error when sponges, sharps, needles, or instruments do not correlate to the actual number of items present, such as undercount or double count (Greenberg et al., 2008).

Misplaced item: Item that is unintentionally lost and may be inside the patient, in the drapes, in the trash, or on the floor and may or may not be subsequently located (Greenberg et al., 2008).

Never event: Medical error that is essentially shocking as it is wholly preventable and should never occur (Koek, 2020).

OR nurse (aka nurse circulator): A registered nurse (RN) who provides care according to the nursing process for patients undergoing surgery or invasive procedures. They have the relevant knowledge and skills to support positive patient outcomes (AORN, 2019).

Radiopaque: This refers to structures that resist the passage of X-rays; they are dense in appearance and visible on radiography (Kusuda et al., 2020). However, materials that cannot be detected by radiograph include wood fragments, light metals (such as aluminum), thin plastic, and human hair.

Raytex: Surgical gauze sponge used by surgeons. The blue string woven through it makes it detectable on X-ray. It is inserted intraoperatively to absorb fluids or isolate tissue and intended for removal prior to end of procedure (Steelman et al., 2018).

Reconciliation count: Count occurs after the incision is closed and all sponges have been removed from the sterile field. Sponges previously removed from the field have been counted and placed in plastic bags with ten sponges in each bag per standard protocol (Greenberg et al., 2008).

Sentinel event: Unexpected or unanticipated patient safety event involving a serious physical or psychological injury, including loss of limb or function or death (Patra & De Jesus, 2022).

Sharps: In this study, suture needles, scalpel blades, and hypodermic needles; any item with points or edges that may puncture or cut (Wallace, 2017).

Soft goods: These items include surgical sponges, cotton balls, blue towels, drape towels, prep swabs, packs, kerlix, and dressing sponges (Steelman et al., 2018).

Surgical Technician (ST): An allied health professional, also known as a scrub or operating room technician (ORT), who works under the supervision of the surgeon, fulfilling the role of the primary scrub. This tech prepares the OR for surgery, sets up sterile field and surgical instruments, drapes the patient, gowns, and gloves the surgeon (AORN, 2016).

Surgeons may use more than 250 different surgical instruments and materials during one operative encounter, depending upon the procedure. The most common sites for RSIs are the abdomen/pelvis/retroperitoneal cavity, vagina, and chest cavity in that order (Steelman et al., 2018).

Appendix C: Permission Letter From AORN

AORN
Association of periOperative Registered Nurses
2170 South Parker Road, Suite 300 Denver, CO 80231-5711 [redacted] http://www.aorn.org/

March 7, 2024

Sherri L. Bobo DNP(c), RN, MSN (Retired)
Abilene Christian University
1600 Campus Court
Abilene, Texas 79601
[redacted]

Dear Sherri Bobo:

Thank you for requesting permission to use portions of the AORN "Competency Verification Tool: Retained Surgical Items" from the AORN eGuidelines+ site as part of a safety project to be viewable on the Digital Commons @ ACU.

Permission is granted to use the text of items 1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 19, 20, 21, 23, 30, 31, 38, 39, and 48 from the Competency Verification Tool: Retained Surgical Items in a project to be viewable on the Digital Commons @ ACU with the following conditions:

1. Permission is good for two years, March 8, 2024, through March 8, 2026.

2. This content may be subject to periodic updating and revision by AORN, and it is your responsibility to be aware of updates and revisions that may make it advisable for this content to be removed from your project. AORN accepts no responsibility for notification of these changes other than what AORN posts on its website and its other communication vehicles.

3. No responsibility is assumed by AORN, Inc. for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any standards, recommended practices, methods, products, instructions, or ideas contained in the above mentioned material. Because of rapid advances in the health care sciences in particular, independent verification of diagnoses, medication dosages, and individualized care and treatment should be made. The above mentioned material is not intended to be a substitute for the exercise of professional medical or nursing judgment.

4. This credit line, as well as the copyright symbol, must appear on the page that uses AORN content:

Reprinted with permission from AORN eGuidelines+. Copyright © 2023, AORN, Inc, 2170 S. Parker Road, Suite 400, Denver, CO 80231. All rights reserved.

5. The content in this publication is provided on an "as is" basis. TO THE FULLEST EXTENT PERMITTED BY LAW, AORN, INC., DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OR THIRD PARTIES RIGHTS, AND FITNESS FOR A PARTICULAR PURPOSE.

6. This permission is not applicable for future editions or revisions or other uses of this content, including additional formats and media. Additional uses require additional permission requests.

Thank you again for your interest in AORN content.

Sincerely,

Zac Wiggy
Managing Editor, Digital Products, AORN

Appendix D: Pretest Survey Questionnaire

Pretest Survey

Name: _____ _____RN _____ST

Please do NOT use your real name on the blank above…choose an anonymous, fictitious name (a pseudonym such as "Wonder Woman" or "Iron Man"). Please use the same name on the Pretest and the Posttest. There is only ONE correct answer to each question below. Please answer the following questions by circling the answer that you think is correct for each question.

CLINICAL SKILLS: UNINTENTIONAL RETAINED SURGICAL ITEMS

1. Surgical counts are crucial and should be performed:
    a. before the incision is made.
    b. when closing a cavity within a cavity.
    c. before and after skin closure.
    d. all of the above.

(Answer: d)

2. Manual counts performed after procedure begins should start with:
    a. sterile field, back table, kick bucket, then Mayo stand.
    b. sterile field, Mayo stand, back table, then kick bucket.
    c. kick bucket, back table, sterile field, then Mayo stand.
    d. none of the above.

(Answer: b)

3. Manual counting in the intraoperative phase of surgery is an essential practice. Its primary purpose is to:
    a. meet counting quotas in the operating room.
    b. audit how many supplies and instruments the surgeon uses.
    c. keep patients safe during surgery.
    d. help circulators and techs develop new surgical policies and guidelines.

(Answer: c)

4. When manual counting is performed by the RN circulator and ST:
    a. maximum attention is required without unnecessary interruptions and distractions.
    b. unrelated conversations are acceptable.
    c. the count can be done by one person.
    d. singing along with the music playing in the OR can be stimulating.

(Answer: a)

5. Unintentional retained surgical item (RSI) left in a patient is largely preventable and considered to be:
    a. a serious event.
    b. a never event that is underreported and underestimated.
    c. a sentinel event reportable to The Joint Commission (TJC).
    d. all of the above.

(Answer: d)

6. Most common items left in patients during surgery or invasive procedure:
    a. sharps.
    b. instruments.
    c. sponges.
    d. needles.

(Answer: c)

7. Conducting surgical counts by RN circulators and surgical techs should be completed while simultaneously documenting counts on:
    a. the count sheet only.
    b. white dry erase board on the wall of the OR.
    c. corner of Mayo stand cover by ST.
    d. scrap piece of paper by the RN circulator.

(Answer: b)

8. According to the Association of periOperative Registered Nurses (AORN), most <u>counting discrepancies</u> in the operative setting involve:
    a. needles.
    b. soft goods/sponges.
    c. instruments.
    d. device fragments.

(Answer: a)

9. Abnormal symptoms that consist of pain, fever, nausea, vomiting, weight loss, abdominal distension and rigidity, increased heart rate, and anorexia can be signs of:

a. infection.
b. bowel obstruction due to previously retained surgical sponge.
c. early pregnancy with complications.
d. inflamed gall bladder.

(Answer: b)

10. Gauze sponges used in the wound by surgeons such as raytex and neurological patties should be:

a. radiogenic.
b. radioactive.
c. radiopaque.
d. four-fold plain white gauze.

(Answer: c)

11. The biggest change to AORN's guidelines for prevention of unintentional RSIs is the recommendation for using:

a. adjunct technology such as radiofrequency identification (RFID) tags.
b. radiological imaging on all procedures.
c. second OR team to help verify count.
d. elimination of manual count entirely.

(Answer: a)

12. Adjunct technology is designed to use along with manual counting and is:

a. not beneficial in reducing surgical count discrepancies or miscounts.
b. associated with fewer retained sponges.
c. has been significantly essential in decreasing near misses and RSIs.
d. b and c only.

(Answer: d)

13. The Sponge ACCOUNTING System developed by surgeon Dr. Verna Gibbs features:

a. blue-backed pocketed system to clearly display sponges.
b. allows bloody sponges to be more visible.
c. emphasizes sponge management practices.
d. all of the above.

(Answer: d)

14. The responsibility of accounting for all items used in surgery, including needles, sharps, soft goods, and instruments belongs to:
    a. surgical tech (or scrub nurse).
    b. nurse circulator.
    c. all surgical team members.
    d. surgeon and anesthesia provider.

(Answer: c)

15. Risk factors for unintentional RSIs during surgery are associated with:
    a. decreased body mass index (BMI).
    b. emergency procedure, unexpected intraoperative factors, more than one surgical team.
    c. low blood loss.
    d. the surgeon's training.

(Answer: b)

16. According to The Joint Commission (TJC), the most commonly reported sentinel event in the operating room is:
    a. surgical fire.
    b. unintentional retained surgical item (RSI).
    c. medication error.
    d. wrong-site surgery.

(Answer: b)

COMMUNICATION AND TEAMWORK SKILLS / SELF-EFFICACY

17. During the counting process, communication between surgical team members should be:
    a. contradictory and highly dynamic.
    b. attentive, participatory, and accurate.
    c. business as usual, not particularly different.
    d. proactive and intuitive patterns of speech.

(Answer: b)

18. Implementation of evidence-based team training in the operating room:
    a. improves communication and collaboration within the team.
    b. introduces team competition.
    c. challenges the team's capacity to adapt.
    d. coordinates the work roles of team members.

(Answer: a)

19. Patient safety and the efficiency and quality of surgical procedures are **most** affected by:
    a. communication failures.
    b. supportive knowledge and technical skills.
    c. interdependency of team members and time constraints.
    d. a and c only.

(Answer: d)

20. Appropriate communication and relationship dynamics in the surgical setting:
    a. does not increase team's awareness of task performance for positive patient outcomes.
    b. strengthens shared knowledge, shared goals, and mutual respect.
    c. may create inaccurate, delayed, and blaming communication.
    d. will not likely reduce inattentiveness or promote effectiveness.

(Answer: b)

Note. Adapted from the AORN *Competency Verification Tool* (revised 2023). Reprinted with permission from AORN eGuidelines+.

Appendix E: Posttest Survey Questionnaire

Posttest Survey

Name: _____ _____RN _____ST

Please do NOT use your real name on the blank above…choose an anonymous, fictitious name (a pseudonym such as "Wonder Woman" or "Iron Man"). Please use the same name on the Pretest and the Posttest. There is only ONE correct answer to each question below. Please answer the following questions by circling the answer that you think is correct for each question.

CLINICAL SKILLS: UNINTENTIONAL RETAINED SURGICAL ITEMS

1. Surgical counts are crucial and should be performed:
    a. before the incision is made.
    b. when closing a cavity within a cavity.
    c. before and after skin closure.
    d. all of the above.

(Answer: d)

2. Manual counts performed after procedure begins should start proximally to distally:
    a. sterile field, back table, kick bucket, then Mayo stand.
    b. sterile field, Mayo stand, back table, then kick bucket.
    c. kick bucket, back table, sterile field, then Mayo stand.
    d. none of the above.

(Answer: b)

3. Manual counting in the intraoperative phase of surgery is an essential practice. Its primary purpose is to:
    a. meet counting quotas in the operating room.
    b. audit how many supplies and instruments the surgeon uses.
    c. keep patients safe during surgery.
    d. help circulators and techs develop new surgical policies and guidelines.

(Answer: c)

4. When manual counting is performed by the RN circulator and ST:
    a. timeout should performed.
    b. unnecessary distractions should be curtailed.
    c. loud music should be playing.
    d. conversations unrelated to the care of the patient can continue.

(Answer: b)

5. Unintentional retained surgical item (RSI) left in a patient is largely preventable and considered to be:

a. a serious event.
b. a never event that is underreported and underestimated.
c. a sentinel event reportable to The Joint Commission (TJC).
d. all of the above.

(Answer: d)

6. Most common items left in patients during surgery or invasive procedure:

a. sharps.
b. instruments.
c. sponges.
d. needles.

(Answer: c)

7. When RN circulators and ST are conducting counts, which of the following can assist:

a. white dry erase board on the wall of the OR.
b. bar-code system and radiofrequency identification systems.
c. radiopaque sponges.
d. all of the above.

(Answer: d)

8. According to the Association of periOperative Registered Nurses (AORN), most counting discrepancies in the operative setting involve:

a. needles.
b. soft goods/sponges.
c. instruments.
d. device fragments.

(Answer: a)

9. Radiological imaging should be performed intraoperatively:

a. on all cases.
b. when the surgical count is incorrect.
c. before the patient leaves the operating room and interpreted by a radiologist.
d. b and c only.

(Answer: d)

10. Arguments for utilizing the Sponge ACCOUNTing System (pocketed bag system) are:
    a. helps to avoid sponges being carried over to next procedure.
    b. good visualization for all OR team members when conducting count.
    c. reduces the potential for sponges to stick together, causing errors with count.
    d. all of the above.

(Answer: d)

11. The biggest change to AORN's guidelines for prevention of unintentional RSIs is the recommendation for using:
    a. adjunct technology such as radiofrequency identification (RFID) tags.
    b. radiological imaging on all procedures.
    c. second OR team to help verify count.
    d. elimination of manual count entirely.

(Answer: a)

12. Adjunct technology is designed to use along with manual counting and is:
    a. not beneficial in reducing surgical count discrepancies or miscounts.
    b. associated with fewer retained sponges.
    c. has been significantly essential in decreasing near misses and RSIs.
    d. b and c only.

(Answer: d)

13. The Sponge ACCOUNTING System developed by surgeon Dr. Verna Gibbs features:
    a. blue-backed pocketed system to clearly display sponges.
    b .allows bloody sponges to be more visible.
    c. emphasizes sponge management practices.
    d. all of the above.

(Answer: d)

14. The responsibility of accounting for all items used in surgery, including needles, sharps, soft goods, and instruments belongs to:
    a. surgical tech (or scrub nurse).
    b. nurse circulator.
    c. all surgical team members.
    d. surgeon and anesthesia provider.

(Answer: c)

15. Risk factors for unintentional RSIs during surgery are associated with:
    a. decreased body mass index (BMI).
    b. emergency procedure, unexpected intraoperative factors, more than one surgical team.
    c. low blood loss.
    d. the surgeon's training.

(Answer: b)

16. According to The Joint Commission (TJC), the most commonly reported sentinel event in the operating room is:
    a. surgical fire.
    b. unintentional retained surgical item (RSI).
    c. medication error.
    d. wrong-site surgery.

(Answer: b)

COMMUNICATION AND TEAMWORK SKILLS / SELF-EFFICACY

17. During the counting process, communication between surgical team members should be:
    a. participatory.
    b. attentive and harmonious.
    c. a and b only.
    d. conflicting and incongruous.

(Answer: c)

18. Implementation of evidence-based team training in the operating room:
    a. improves communication and collaboration within the team.
    b. introduces team competition.
    c. challenges the team's capacity to adapt.
    d. coordinates the work roles of team members.

(Answer: a)

19. Patient safety and the efficiency and quality of surgical procedures are **most** affected by:
    a. communication failures.
    b. supportive knowledge and technical skills.
    c. interdependency of team members and time constraints.
    d. a and c only.

(Answer: d)

20. Appropriate communication and relationship dynamics in the surgical setting:
    a. does not increase team's awareness of task performance for positive patient outcomes.
    b. strengthens shared knowledge, shared goals, and mutual respect.
    c. may create inaccurate, delayed, and blaming communication.
    d. will not likely reduce inattentiveness or promote effectiveness.

(Answer: b)

Note. Adapted from the AORN *Competency Verification Tool* (revised 2023). Reprinted with permission from AORN eGuidelines+.