

2023

Improving Provider Knowledge on Surgical Site Infection Prevention Using a Surgical Surveillance Education Program

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Improving Provider Knowledge on Surgical Site Infection Prevention Using a Surgical Surveillance Education Program

A Scholarly Project Presented to the Faculty of the
Nicole Wertheim College of Nursing and Health Sciences

Florida International University

In partial fulfillment of the requirements
For the Degree of Doctor of Nursing Practice

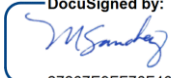
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Date: _____ 7/30/2023

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By

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Abstract

Improving Provider Knowledge on Surgical Site Infection Prevention Using a Surgical Surveillance Education Program

Background: Surgical site infections are a serious adverse outcome following any surgery. Despite the presence of international and standardized hospital guidelines, the prevention of surgical site infections remains a challenge for private practices and ambulatory centers. Currently, most ambulatory centers rely solely on provider reporting for their infection control reports and the education on prevention in these practices is minimal. It is critical that healthcare professionals have appropriate knowledge on surgical site infections, prevention methods and on their role in implementing evidence-based prevention strategies such as a surgical surveillance program.

Purpose: The purpose of this quality improvement project (QIP) was to improve healthcare professionals' knowledge on surgical surveillance and its potential impact on infection prevention in private and ambulatory settings.

Methods/practice: The findings from the literature helped guide this QIP. A test was created to be used in the pre- and post-intervention phases. The test consisted of 4 demographic questions and 10 knowledge questions on current surgical infection prevention practices, surgical surveillance guidelines including telehealth follow ups, and 4 ungraded self-knowledge level questions. Ten participants completed the pre-test, and ten participants completed the educational session and post-test. A 30-minute evidenced-based educational session was conducted at a primary care clinic on indirect surgical surveillance and how it can be utilized in private practice to improve patient outcomes.

Conclusion: The findings indicated that the participants lacked the appropriate education and information on what surgical surveillance entails and how it can be utilized in private settings. Findings from the post-test indicated that the educational session did increase the knowledge of the participants on surgical surveilling and how it can directly impact patient outcomes. Post-test scores improved 29% over pre-testing scores following the educational session.

Implications for Practice: There is a lack of education and implementation of surgical surveillance guidelines in private practices across the country. Both educational leadership and management should implement the continuous and important education on how to properly utilize surgical surveillance to ensure the best and safest care is being provided to patients.

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Chapter I

Introduction

Sattar et al. (2019) noted that wound infections after surgery are referred to as post-operative surgical wound infections. The infection rates differ from one hospital to another, and the site may be restricted to sutures. However, it may also expand to the operative site. Surgical wound infection is classified under nosocomial infection. Importantly, this type of infection has been acquired in healthcare facilities or hospitals. For a patient to develop a nosocomial infection, they must have been in the healthcare facility or hospital for other reasons unrelated to the infection. Notably, the patient should not display any signs of incubating or active infection. Many orthopedic patients acquire post-operative SSIs. These infections may be lethal and are a relatively common cause of death.

However, they are characterized as significant causes of death among surgical patients. Post-operative infections are responsible for about 2 million nosocomial infections happening every year. Moreover, SSIs result in increased treatment costs, higher bed occupancy, and prolonged hospital stay. In many developing nations, the lack of resources results in high mortality and infection rates, even for simple surgeries such as cesarean sections and appendectomies (Sattar et al., 2019). Orthopedic surgeries, including internal spine fixation and joint replacement, may lead to complications associated with post-operative sepsis. Such complications may even result in the death of a patient.

SSIs are normally caused by endogenous or exogenous pathogens, mostly anaerobic and aerobic bacteria that attack the operative wound during or post-surgery. These infections pose a significant danger to orthopedic surgeries compared to other procedures because of the application of metallic implants that accommodate the pathogens (Radhamony et al., 2021, p. 1).

In that sense, eliminating the infection is challenging. The prevalence of SSIs differs from 1% in particular healthcare settings in the USA and Europe to a significant value of 20% in some regions of Sub-Saharan Africa and Asia (Radhamony et al., 2021, p.2).

PICO: In outpatient orthopedic post-surgical patients, what is the effect of a surgical surveillance program implementation on the rate of surgical site infections versus no infection prevention focused program?

Problem Statement & Significance

It is worth noting that routine surgical site infection (SSI) observation is minimal, especially in outpatient/private settings. Importantly, this poses a great risk to patient safety because currently there are very little education programs in place to guide outpatient and private clinicians on safety and prevention. Heightening the level of education and surveillance for ambulatory surgical patients is crucial for lowering the likelihood of infections. Implementing a surgical quality enhancement education program that encompasses post-discharge monitoring and a prompt 3-4 day follow up visit may assist in enhancing ambulatory surgical center compliance to control measures and patient adherence to care.

The lack of such an evidence-based guidelines or programs in place may result in more healthcare issues than just surgical site infections, including adhesions, frequent admissions to healthcare facilities, lower range of motion, osteomyelitis, prolonged healing period, decreased physical treatment, and septicemia. It is worth mentioning that ambulatory centers and private practices lack surveillance programs that would assist in lowering infection rates. In that sense, this project proposes the creation of a quality improvement program that would be used in private practices and ambulatory centers to improve patient outcomes and lower infection rates.

Bundling together approaches to improve the risks of infection associated with surgery has been researched and implemented in mostly hospital settings. The significance of implementing an education project that follows and teaches a similar bundle structure to reduce surgical site infections in elective ambulatory surgeries is crucial. Research conducted by Kwon et al. (2013) details how The National Surgical Infection Prevention Program in support of the National Surgical Infection Prevention Project implemented by the Centers for Disease Control and Prevention and the Centers for Medicare & Medicaid Services demonstrated that a bundle of interventions that includes glucose control in surgical patients was followed by decreased rates of surgical infections.

Currently, most ambulatory surgical centers & private practice centers have a physician self-reporting system for infection reporting & control. This not only creates a bias in reporting surgical site infections, but also leaves room for any surgeon or facility to determine what an infection entails and whether it is reportable as an SSI or not. By creating a standardized surgical surveillance program education, evidence-based guidelines will provide the groundwork and definitions needed for accurate reporting and trend following. Prompt action is imperative when it comes to surgical site infections to reduce further complications.

Background

Surgical site infections are a serious adverse outcome following any surgery. Despite the presence of international and standardized hospital guidelines, the prevention of surgical site infections remains a challenge for private practices and ambulatory centers. Currently, most ambulatory centers rely solely on provider reporting for their infection control reports and the education on prevention in these practices is minimal. It is critical that healthcare professionals

have appropriate knowledge on surgical site infections, prevention methods and on their role in implementing evidence-based prevention strategies such as a surgical surveillance program.

An operative procedure refers to the process included in CPT NHSN or ICPD-10-PCD surgical procedure code mapping. It occurs when an incision, including a laparoscopic procedure, is made through the mucus membrane or skin. The procedures may also be made through a pre-existing incision. These processes usually occur in a surgical theatre that adheres to the American Institute of Architects (AIA) guidelines regarding the qualities of an operating room. (CDC/NHSN, 2022). In this project, the operating room will encompass outpatient surgical rooms in the outpatient hospital and ambulatory surgical settings, which align with AIA criteria. Various elements must be considered when establishing wound care surveillance and visits.

The National Healthcare Safety Network & the CDC (2022) developed a manual addressing surgical site infection. The manual contains some surveillance methods that must be used for post-discharge monitoring of outpatient surgical procedures. That said, the proposed project will utilize the recommended methods with the SSI monitoring period discussed by medical personnel together with infection diagnosis codes outlined in ICD-10-CM.

Scope of the Problem

The population under study here are the providers and staff that interact with and are an integral part of the patient's recovery and infection prevention process. Understanding how patients may present before developing an infection or in the early stages of infection is vital to the education for this program. Clinicians and all staff involved must note that these patients display some characteristics that call for more care even after being discharged from the ambulatory centers. One major characteristic of these patients is soreness which usually occurs

after the patient has undergone the surgical procedure. However, the soreness reduces gradually as the patient receives care. Most post-operative orthopedic patients report muscular pain, especially around the incision region. The pain may decrease or heighten depending on the incision area and the presence of SSIs. Most post-operative orthopedic patients also have relatively high temperatures a week or two post-surgery (Willhuber et al., 2018). Nevertheless, persistent fevers experienced more than seven days after the surgery are a major sign of a surgical site infection. In that manner, it is recommended to have a practitioner make an early follow-up visit & be well versed on the tools available to ensure that they manage any abnormalities associated with the orthopedic surgery, including any surgical site infections.

Tucci et al. (2019) noted that surgical site infections (SSIs) among patients who have undergone orthopedic surgery are a problematic and prospective catastrophe for both patients and surgeons. Notably, the prevalence of SSIs among orthopedic patients makes it challenging for researchers to conduct good quality studies with appropriate sample sizes. Many researchers cannot draw effective conclusions concerning the subjects associated with preventing SSIs among orthopedic patients. While numerous studies have provided evidence regarding SSIs among orthopedic patients, some fundamental problems remain unresolved (Tucci et al., 2019, p 224). The development of SSIs after orthopedic surgery is probably influenced by some elements, including surgical interventions, patient characteristics, post operative surveillance and perioperative care/education.

SSIs among post-surgical orthopedic (open and laparoscopic) patients are caused by various factors. According to Najjar et al. (2018), the factors are categorized into classes: pre-operative risk elements such as diabetes, obesity, and male sex. Intraoperative risk elements include factors such as the frequency of utilization of prophylactic antibiotics, time of antibiotic

administration prior to incision and operating room traffic. Post-operative risk elements include the use of drainage systems, patient education, lack of surveillance and blood transfusions (Najjar et al., 2018, p 2).

Patients who undergo orthopedic procedures have a high probability of other factors that heighten the risk for SSIs, for instance, surgical site infections by airborne bacteria and skin normal flora, which may come from the operating theatre environment or the medical personnel. Thus, it is crucial to address the risk elements for orthopedic SSIs in all settings that conduct procedures and throughout the post, intro- and pre-operative periods. Other factors exist like language barriers, lack of surveillance, patient education and lack of standardized protocols. All of these elements culminate in increase healthcare costs.

Wound care and healing are linked to various elements, including age, nutrition, certain comorbidities like diabetes, previous history of surgical site infections, operation duration, and other hygienic properties. SSIs account for an increased percentages of healthcare-associated infections (HCAIs), approximately 20% of all HCAs; affecting more than 5% of all surgical patients. Moreover, wound dressing is reported as one element that impacts wound healing. The practice of wound dressing where gauze is often said to be disruptive because it results in drying the wound while damaging the tissues when removed. Ineffective dressing practices may result in unanticipated adverse effects (Mwakanyamale et al., 2019, p 872). The management of post-operative incisions is said to receive less attention while it is a major factor influencing chronic wound healing. Implementing a surgical site focused program with a practitioner that includes a telehealth visit 2-3 days post-surgery can prove to be effective for managing SSIs amongst orthopedic patients. Evidence from various studies shows the effectiveness of wound care visits by a practitioner several days after a patient has undergone orthopedic surgery.

Oropallo *et al.* (2021) noted that increased wound care visits by a practitioner in a patient home enable them to identify and address all the issues that may affect the healing process, for instance, signs of infection, adherence issues by the patients, issues associated with home nursing services, potential issues with home supplies and aspects such as whether the infected area needs debridement. Home care visits by the practitioner 3-4 days after a patient has been discharged from the hospital also helps in reducing social isolation, which positively impacts the patients. It has been stated that wound care visits by a practitioner 2-4 days after a patient undergoes orthopedic surgery results in better outcomes than when no visits and follow-ups are made. Some elements that should be considered to effectively tailor the post-surgical wound care visits include patient specific information that can directly impact their healing process (diabetes, respiratory issues, mental health), the ability of the patient or caretaker to care for the incision(s) appropriately and the progression of the wound (Oropallo et al., 2021, p 14).

Thomsen et al. (2021) carried out a study to examine whether follow-up visits by a geriatric team (OGT) lowers hospital readmission rates among patients discharged from a facility. The population under study included all the discharged patients hospitalized in the Danish geriatric department between January 2016 and February 2020. The visits aimed to address future changes in readmission or discharge trends during the research period. The researchers also examined patients discharged from the same facility and allowed to go home. The OGT visits were done seven days after the patients were discharged from the facility. The total number of patients in the study was 847 (Thomsen et al., 2021).

Results from the findings indicated no variations between the two groups concerning their sex, age, daily activities, and 30-day mortality. The cumulative prevalence of readmission was 39.8%, while the unadjusted risk of readmission among patients who received OGT visits

was 0.68 compared to those who did not get any visits (0.72). In that manner, the study concluded that OGT follow-up visits to discharged patients considerably lowered the readmission rate among older patients (Thomsen et al., 2021).

Provider visits include specialists and general practitioner visits, for instance, cardiologists and family medicine practitioners. Generally, provider visits are necessitated by increased demand for non-emergency health care. The frequency and number of visits made to a specialist usually depends on the long-term or short-term needs of the patient (Gonçalves & Weaver, 2016, p. 205). Some patients may require appointments more regularly than others depending on their pre-existing conditions, current levels of pain or other factors.

The study by Gonçalves & Weaver (2016) wanted to examine the resultant impacts of home care on the use of all forms of inpatient care and doctor visits. The study was conducted among an adult population in Switzerland. The researchers utilized time-fixed, canton, and IV effects. Results from the study indicated some differences in the impact of home care visits by age groups (<65 and 65+) (Gonçalves & Weaver, 2016, p. 230). Also, variations were seen in households with informal care and those without informal care. The researchers found a positive impact of home care visits on the probability of lessend hospitalizations.

The researchers also found a considerably positive impact on how home care visits by a practitioner lessen the patient's burden of visits to an office. On this point, home care visits can trigger access to physician care, but there are no impacts on the frequency of visits (Gonçalves & Weaver, 2016, p. 230). While the impact on hospitalization is small, the positive impact on the probability of hospitalization increases among patients aged 65 years and above and those lacking proper care in their homes.

A study by Frazee et al. (2019) shows that home visits are desired for various patient populations and services. In the study, the researchers used national survey data from accountable care organizations (ACOs) and physician practices and qualitative interviews to investigate the impact of utilizing home visiting programs. The study showed that physician practices engaged in ACO had more likelihood than the non-ACO facilities. Notably, 80% of the ACO executives noted that they have used home visits for complex clients. The findings from the study report that home visits are evidence-based measures that decrease expenditures and enhance results for patients with severe illnesses or those discharged from a healthcare facility.

They are also effective in supporting care for the elderly. Most of the ACOs interviewed in this study reported using home visits for such patient populations and others despite having varied clinical needs. Importantly, the study's findings support the use of home visits by ACOs, noting that they are effective in locating and understanding non-compliant patients. Home care visits also enhance the quality of services given to patients since they are tailored according to the patient's needs (Frazee et al., 2019, p. 1025). By implementing home care visits as a care measure, the ACOs could effectively track and monitor the patients. Using these visits helped discover care barriers and improve patient outcomes.

Knowledge Gaps

Failing to integrate a wound care-focused visit in the treatment plan for post-operative orthopedic patients can increase surgical site infections rates and prolong vital patient care which can turn into a patient safety issue as well. The reason a general follow-up visit with a physician may be likened to a "one-size-fits-all" approach to post-operative care patients where similar post-operative strategies are used without considering elements that differ from one patient to another. For instance, the age of the patient, the severity of the SSIs, presence of a chronic

conditions, patient comprehension and also potential patient allergic reactions to medications (Koh et al., 2021). When a wound-focused visit or standardized surveillance program lacks a personalized patient treatment plan and education, it is probable that the chances for infection and delayed healing are high. When the health practitioner adopts a general follow-up visit, they will not know about the specific potential complications causing surgical site infections because they would only do a general checkup rather than a patient-centered personalized checkup. In that sense, they may not identify any elements influencing SSIs in the post-operative patient, meaning that the infection will persist, resulting in hospital admission.

The post-surgical complications or SSIs may be too severe, resulting in the patient's death. Some surgical site infections can take a long time to heal if they are not being properly addressed and can result in sepsis. The lack of wound care-focused visits can result in decreased quality of life, negative health outcomes and decreased patient satisfaction. Since the health practitioner does not focus on the surgical site infection but rather a general assessment of the patient, they are likely to miss a lot of information regarding the nature and severity of the potential infections. When such properties are not identified, the patient may continue to live with them as a normalcy. For instance, a patient with chronic pain may not want to get up and bathe properly which can lead to infections if the pain management is not addressed promptly. Some patients are also likely to develop post-surgical distress, especially when they continue to experience complications associated with the surgery.

The lack of a standardized surgical safety program can also increase the chances of the patient not regaining control over the professional or individual aspects of their life. This can lead to new or further worsening of mental health issues. If there is no focus on the surgical site, proper care, education, signs of infections or complications the patient may miss pertinent signs

or symptoms that can help guide the practitioner towards an early diagnosis and potentially save the patient's life. A perfect example is a patient who undergoes a hip-replacement surgery, they will experience challenges in walking or engaging in any house chores or even leisure activities because of unaddressed pain, soreness, swelling or tenderness caused by early post-surgical infections. Increased pain may force the patient to be grounded and depend on other people for basic things such as walking around and toileting, thus further limiting the patient.

Proposal Solution/Outcome

Creating a surgical surveillance education program highlights implementing post-operative visits which can potentially decrease the rates of SSIs associated with post-surgical orthopedic procedures & understanding the importance of evidence-based practices and tools utilized to aid in the reduction of infections. Patients with chronic or progressive illnesses may require additional support and other specialists. Not having this program in place may leave patients and providers with unmet requirements or expectations, which may adversely impact the quality of life and well-being of the patient. Some examples include coping skills, learning about post-operative complications, addressing changes early on, knowing their resources and who to call, or getting help with daily activities that include dressing changes.

Adopting policies and protocols that are evidence-based such as a wound-focused follow-up visit can significantly improve the quality of life, patient satisfaction, adherence to medication, and health outcomes associated with surgical recovery. The practitioner can identify and address underlying health issues using the education provided in this surgical surveillance protocol education, including the SSIs associated with the surgical procedure. It is assumed that a personalized follow-up visit will help reduce the incidence of SSIs, thus enhancing patient satisfaction and outcomes. Through wound-focused follow-up visits, the practitioner will also

provide support, personalized medication counseling, and proper referrals when needed. As a result, rates of admission to hospitals associated with post-surgical infections can be significantly reduced.

Chapter II

Literature Review

Surgical site infections (SSIs) have well-known adverse effects, including patient death, higher disease rates, and higher healthcare costs (de Oliveira & Sarmento Gama, 2017). However, if evidence-based approaches are considered when caring for surgical patients, SSIs might be significantly reduced. Reduced rates of SSIs might be achieved with the use of a standardized surgical surveillance education program. Making the connection between a standardized surgical surveillance protocol and decreased rates of surgical infections is key in creating and implementing this strategy. Improving patient outcomes by way of education program implementation and consistent follow up for a pre-determined time will also decrease the rate of hospital admissions following discharge from ambulatory centers.

Search Strategy

The goal of this quality improvement project is to showcase the impact a surgery surveillance program would have on infection rates in orthopedic surgical patients ages 20 – 65 years old through an education implementation. A search strategy to locate all relevant and useful evidence on the topic was established. Healthcare related journal electronic databases were utilized to identify articles that are relevant and inclusive of the topic for this project. These databases included CINAHL, Medline, PubMed, National Library of Medicine, PLOS One, Ovid, & Google Scholar. Each database was used to search the problem key words – “surgical site infection” and “infection prevention”, along with the propositioned intervention “post-

surgical surveillance”. Preliminary searches were done using these keywords along with the Boolean operator AND. Supplementary search terms were utilized, including synonyms and the Boolean operator OR. For the initial search terms identified, the following synonyms were searched to locate articles in each database:

- “Wound infection” OR “SSI” OR “Surgical infection”
- “Infection observation” OR “infection control”
- “Surgical infection prevention” OR “Infection protocol” OR “Surgery surveillance”

To ensure the results support the proposed change and project research, certain filters were used. Database searches were limited to all articles published within the years of 2012-2022. Other limiters included articles that are peer-reviewed, published in English & are also available in full text. For each correlating article, the abstract and conclusion were both assessed to determine if the study was relevant to the proposed PICO question and/or project goal. When searches returned more than 240 articles, only the first 200 were reviewed. All relevant articles were placed in an individual file for full-text review. All duplicates were removed as a part of the evaluation process followed by a review of full text articles for a final determination of relevance to this project. Using Ackley et al. (2008), Levels of evidence guide (Table 1), ten articles with the highest level of evidence (I-IV) and relevancy were selected for this project. A table of evidence can be found in Appendix B. for these works.

Table 1

Level of evidence (LOE)	Description
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial) or evidence-based clinical practice guidelines based on systematic reviews of RCTs or three or more RCTs of good quality that have similar results.
Level II	Evidence obtained from at least one well-designed RCT (e.g. large multi-site RCT).
Level III	Evidence obtained from well-designed controlled trials without randomization (i.e. quasi-experimental).
Level IV	Evidence from well-designed case-control or cohort studies.
Level V	Evidence from systematic reviews of descriptive and qualitative studies (meta-synthesis).
Level VI	Evidence from a single descriptive or qualitative study.
Level VII	Evidence from the opinion of authorities and/or reports of expert committees.

Eligibility criteria

Data from studies that met the following criteria were included in the review:

1. They were observational studies (cross-sectional, case-control, or cohort studies).
2. They were published between 2012 and 2022.
3. They were published in English.
4. An abstract and a full text was available for this review.
5. Had a high level of evidence (I-IV) on the LOEG by Ackley *et al.*

Ineligible studies included those that:

1. Had a low-quality score according to the predetermined criteria.
2. Did not measure the primary outcome of interest (SSI).
3. Not readily available.
4. Included only patients who had undergone non-classified surgeries

Summary of the Literature

Background on SSIs

Surgical site infection is one of the most common complications after orthopedic surgeries because of the complexity of orthopedic surgery and use of implants in orthopedic surgery all contribute to the risk of SSI (Yang et al., 2020). Surgical site infections have a great impact on the patient, their families, and the healthcare system. The complications and prolonged hospital stays that are attributed to post operative infections are astounding. According to McGillicuddy et al. (2016), wound-related complications cost the health care system over \$10,000 per patient, in addition to the expected patient and provider costs. Many of these procedures are elective and are disputed by health care carriers (McGillicuddy et al., 2016).

Knowledge on risk factors for surgical site infections is imperative when trying to create a program that is geared towards reduction. According to Monegro et al. (2022), risk factors for SSIs include both patient factors such as age, diabetes, obesity, current nutritional status, colonization, co-existing infections, and operative factors such as duration of the procedure, skin antisepsis techniques, surgical technique, and antimicrobial prophylaxis. There are certain pathogens that tend to colonize specific areas of the body that are warmer and/or moist. Regarding orthopedic surgeries, this can be more commonly found in shoulder surgeries or femur surgeries where the groin and axilla are within proximity.

Singular method approaches have been studied for many years in relation to SSI reduction. More recently, researchers are finding that significant reduction in SSIs are attributed to surgery specific bundles or surveillance programs (Kenaan et al., 2014). Another study by Bert et al. (2017), highlights that the use of a surgical bundle seems to reduce significantly the SSIs rate for colon surgeries.

Background on Infection Prevention

Since the introduction of surgical antiseptics in united states around 1876, post-surgical infections have gradually decreased over time. Even though surgical procedures have improved, and prophylactic antibiotics have historically been used to prevent infections, the occurrence of SSIs has not been abolished. To this day, SSIs remain one of the most significant causes of death and prolonged illness. There are no restrictions on who should participate in the shift in clinical practice when it comes to prevention of infections. These professionals may include a doctor, an advanced practitioner, a prosthetist, a surgical tech, a vascular tech, an LPN, or an RN. Every member of the care team is aware that they may consult with each other and utilize evidence-

based practices for information on the surgical procedures, the patient's contributing factors to potential infections and proper protocols and utilization.

Surgical site infections account for approximately 22% of all hospital acquired infections (HAI) according to Monegro et al. (2022), making it the second highest HAI. Surgical site infections are usually caused by *Staphylococcus aureus* and sometimes include Methicillin-resistant *staphylococcus aureus* (MRSA) (Monegro et al., 2022). The implementation of vigorous infection surveillance and prevention protocols has resulted in some achievement in the prevention of HAI (Monegro et al., 2022).

The greatest surgical patient concerns come from the potential of an infection. Both in hospital and in outpatient settings, there is an ongoing need for policies and programs in place that help protect patients and help with implementation of best practices. Reducing the rate of re-admissions due to infections is also a main goal for both patients and providers. Melvin et al. (2017) speaks on how infectious complications were associated with more than one-third of all re-admissions after lower extremity procedures. While this study focuses on a specific area of surgery, there are various studies and analyses that support the notion that all surgeries pose a high risk for infections. It is imperative to note that Melvin et al. (2017) also emphasizes that the predictors of re-admission within 30 days from infectious complications included longer stays, greater co-morbidity burdens, hospitalizations in teaching facilities, a hemoglobin <8 g/dL, and an existing infection during the initial stay.

Classification of SSIs

Infections at surgical sites were once known as wound infections. The CDC and The National Healthcare Safety Network (2021) collaborated to define SSI as any infection at the site

of surgery. SSI may be either superficial or deep and can also be organ/space related. A superficial SSI is an infection localized to the subcutaneous tissue exclusively. Deep SSI occurs when infection spreads into the underlying muscle and tissue. Peritonitis, an intra-abdominal abscess, and an infection in the space around a joint are all examples of organ/space SSIs. Among all SSIs, 47% are superficial, 23% are deep, and 30% are organ/space, as shown by data from the CDC's National Nosocomial Infection Surveillance (NNIS) system. Only 46% of SSIs are identified during the first hospitalization, whereas 16% are identified after discharge, and 38% are identified upon readmission (De Guzman, 2021).

SUPERFICIAL SSI

An infection that appears within the first 30 days after surgery. Infection of the skin or subcutaneous tissue, when at least one of the following applies:

- Pus drainage, with or without laboratory confirmation.
- Bacteria were detected in the wound culture.
- Inflammatory symptoms include pain, redness, and a rise in temperature in that area.
- The analyzing surgeon identifies the SSI as a superficial one.

DEEP SSI

Infection that develops in the first 30 days following surgery (if no implant was used) or the first year (if an implant was used) is considered a surgical site infection. The infection must be present in the deep soft tissues, such as the deep facial layers, and at least one of the following conditions must be met:

- Pus drainage after a significant incision, but no organ or space drainage.

- If the patient exhibits symptoms of fever, inflammation, or an incision that has been surgically or naturally opened.
- Examining the deep incision revealed an abscess.
- The emergency room physician diagnoses a severe SSI.

ORGAN/SPACE SSI

Postoperative infections match the following characteristics and seem connected to surgery but affect organs or places other than the incision site. Infections that develop within 30 days if no implant was used, or within 1 year if an implant was used, are included in this criteria (Zabaglo & Sharman, 2022).

- Pus drainage from an organ or cavity.
- Observation of microbial growth in a culture made from fluid from an affected organ or space.
- When looking at the abscess head-on, you can tell which organ or space it is in.
- The attending surgeon in the affected organ or space diagnoses septic shock.

Risks for Surgical Site Infections

A systematic review conducted by Korol et al. (2013) details the major risk factors associated with both *S. Aureus* and MRSA surgical site infections as variables describing reduced patient fitness such as co-morbidities, advanced age, risk indices (ASA or NNIS), increased BMI, and patient dependence. Some other significant indicators included increased length of pre-operative hospital stay, and surgery complexity including increased surgical time. Increased surgical time and premature prophylactic antibiotic use have been documented to contribute to more infections. In this review, identified risk factors were heightened on patients

who were less fit, have greater in-hospital exposure time, and/or are undergoing longer and more complex surgeries, such as total joint replacements, are at an increased risk for SSI (Korol et al., 2013).

In the research conducted by Melvin et al. (2017), microbiology examinations at re-admission after being discharged from a lower extremity surgery demonstrated gram-negative bacteria in more than 40% of infections. This shows a significant difference from the other articles who mention mostly gram-positive bacteria such as *S. aureus* and MRSA. The implementation of a prophylactic antibiotic administration prior to discharge for high-risk patients has not been studied enough to effectively make it an evidence-based practice. Melvin et al. (2017) states that further assessment of the high-risk vascular patients prior to discharge and consideration of antibiotic administration for gram-negative organisms at the time of re-admission may improve patient outcomes.

Comorbidities are continuously found to be associated with increased risk of SSI incidence. The most frequently mentioned and studied co-morbidity is diabetes. In a systematic review, 85% of studies reported a statistically significant increase in infection rates amongst patients with diabetes (Koro et al. 2013). Other co-morbidities that show significant associations include chronic obstructive pulmonary disease, coronary heart disease, congestive heart failure, acute myocardial infarction, renal insufficiency, hypertension, and osteoporosis. Osteoporosis is seen in a high number of total joint replacement surgeries and has been associated with increased risk for SSI.

The risk of SSI is increased by both patient variables (such as age, smoking, diabetes, and malnutrition) and procedural factors (such as an impaired immune system) (including emergency surgery and the degree of bacterial contamination of the surgical wound at the time of the

procedure). While many of these risk factors are fixed, most SSIs are considered preventable, and recent studies have expanded our knowledge of how hospitals may take preventative measures. Studies from a wide range of disciplines frequently investigate many clinical situations, enabling researchers to evaluate the influence of a broader range of risk factors on SSI rates. Several clinical studies have investigated multivariate patient groups about specific risk factors.

Two models, the Efficacy of the National Nosocomial Infections Surveillance (NNIS) index and the Nosocomial Infection Control (SENIC) index, were created to regulate strategies and reduce morbidity and mortality from post-surgical infections (Ercole et al., 2017). There is a multi-factorial risk for SSI, which is increased in patients with factors such as diabetes mellitus, obesity, anemia, immune-suppressant drugs, corticosteroid use, or malnutrition. Patients' glycemic control following surgery, as well as their general health and duration of hospital stay, are additional factors to consider. Remote infection, high body temperature before surgery, and the presence of drains are all risk factors for SSI. According to a literature analysis, the American Society of Anesthesiologists (ASA) score is also associated with postoperative infections. ASA classification is an indicator for inconsistency in readmissions for patients having surgery for orthopedic fractures. The ASA score is a universally collected data point, making this model a more accurate predictor in a patient's postoperative course and in calculating the expected risk for re-admission (Sathiyakumar et al., 2015).

In most studies, ages 50 and above have been linked to an elevated risk of SSI. One research did find no statistically significant effect of this variable. The World Health Organization found that patients less than one year old and those older than 64 years old were more likely to get an infection in a healthcare facility. Immunocompromised patients such as

people with HIV are always more vulnerable to bacterial infections. The limited incidence studies on nosocomial infections in HIV-infected people imply they are at a higher risk of infection. An increased incidence of SSI and sepsis occurring because of elective surgical procedures in HIV positive individuals has been documented. Nonetheless, surgeons maintain that recovery takes no longer than usual once sepsis is treated, and an average hemoglobin level is obtained.

Prevention of Surgical Site Infections & Patient Education

Although precise measurement may be a challenge in patient safety, the development of standard metrics that allow monitoring of infection rates over time and comparing infection rates across institutions has helped prevent SSIs (and HAIs in general). National Healthcare Safety Network at the CDC developed the criteria for assessing SSI (NHSN). Both tools use the same criteria, but NSQIP takes a very different approach to infection monitoring. Many academics and quality-improvement groups use both the NHSN and the NSQIP criteria. The World Health Organization and the Centers for Disease Control and Prevention (CDC) have issued guidelines that synthesize the evidence for therapeutic interventions to prevent SSI, the most current released in 2017.

However, as is the case with many other quality issues, making the suggested procedures the norm and maintaining the usage of preventative measures has proven difficult. Sustained reductions in SSIs have been achieved by many institutions' thanks in large part to AHRQ's pioneering work to disseminate and implement preventative techniques. Organizational interventions to reduce the occurrence of SSIs (and other HAIs) should focus on fostering a safety culture, implementing efficient data recording and feedback systems, and using checklists and other evidence-based bundles.

The AHRQ Safety Program for Surgery implemented a multicomponent intervention to improve safety culture, boost utilization of the World Health Organization's surgical safety checklist, and reduce SSI rates. The research should have implemented an explicit bundle of therapies aimed at SSI due to the lack of data for SSI prevention and that defects in safety systems that lead to SSI may differ among institutions. Bundled treatments may help institutions reduce the risk of SSIs, although the precise components will likely vary each institution (Park et al., 2020). Another attempt to help patients regain their feet following surgery is the AHRQ Safety Program to Improve Surgical Care and Recovery. This effort aims to take a comprehensive approach to reducing SSIs and other kinds of patient harm across the board in the surgical care process.

A systematic review by Kamel et al. (2012) found that preoperative showers efficiently sanitize the surgery site and lower the risk of SSIs. When antiseptic wipes and showers are used together, the likelihood of contracting a skin infection (SSI) is dramatically decreased. Preoperative skin antiseptics were studied in 20 studies including 9,520 adult and pediatric patients from January 2001 to June 2011. (Chang, 2017). In two cohort studies, patients who used chlorhexidine wipes had a significantly decreased risk of infection (Educational Prevention Program of an SSI in a Metropolitan Pediatric Hospital)—cleaning up with a shower and some antiseptics before surgery has been shown in two randomized controlled experiments to considerably lower colonization rates. This study does not attempt to determine the best antiseptic; instead, it focuses on preventative measures for SSIs.

Separate research led to the development of a randomized prospective study of bathing with chlorhexidine clothes before to hospital admission. About a third of the study's subjects still need to finish the pre-admission shower rituals, which greatly limited the information gathered.

As a result, it was clear how crucial it was to provide clear patient instructions before operations. The purpose of the research was to lower the risk of surgical site infections (SSIs), thus it advised that all patients wash in chlorhexidine clothes before surgery and get a reminder by text, email, or phone call to make sure they followed the procedure (Edmiston et al, 2015). The results of this study suggest that the occurrence of surgical site infections may be significantly reduced by using chlorhexidine and adhering to strict standards of cleanliness before surgery.

The findings support the training program's success by demonstrating the correlation between preoperative and intraoperative cleanliness and a lower risk of infection at the surgical site. The Centers for Disease Control and Prevention suggest that patients use an antiseptic agent, such as antimicrobial or non-antimicrobial soap, whenever they shower (2018). It has been suggested that patients who shower the night before surgery had a lower risk of infection at the surgical site. Research from MEDLINE, PubMed, CINAHL, and the Cochrane Library informed these sanitation guidelines. To lessen the incidence of SSI, these protocols are now extensively used.

From a survey of 50 surgical patients, Anderson et al. (2014) found that 26% agreed that reminders and training materials could be simplified to help avoid surgical site infections (SSIs). Almost half (46%) of respondents indicated they had never been exposed to any form of information or instruction on SSIs. Research findings stress the need to educate patients on reducing their risk of SSIs. The risk of SSI increases when patients are not engaged in their treatment. As a consequence of this study, the argument for creating educational materials for SSIs as part of the quality improvement program has solidified.

It is known that the current English reading level in Miami, FL amongst adults averages to a 5th grade reading level. This means that all education material or information that is relayed

to patients must be easily digestible and as simple as possible. Education and self-determination may serve as a shield against SSIs, according to a study by Edmiston et al. (2014). One way to do this is by careful pre-op preparation and open communication channels between the providers and patient. Both providers and patients need to be able to demonstrate this via their contacts with the healthcare system.

The findings of Rawson et al.'s (2016) extensive patient focus groups suggest that healthcare workers fail to involve patients in the decision-making process regarding infections and their care, leading to frustration, resentment, and anxiety on the part of the patients. Low communications by HCWs, low health literacy, lack of comprehension, and poor-quality information on the subject have all been cited as reasons why patients seek information from dubious online sources. Here, patients can find detailed, yet easy-to-understand information on what they can do before, during, and after surgery to lessen the likelihood of acquiring an infection at the surgical incision. While educating patients on the ideas provided here, HCWs should keep patients' health literacy requirements in mind to ensure that the prevention advice is tailored to each patient's needs and is readily comprehended. The objective is to create a learning environment where patients feel comfortable discussing their surgical treatment options and asking questions.

Antibiotic prophylaxis for surgery is a leading cause of antibiotic overuse in hospitals. There is a large amount of evidence suggesting that short-term prevention is just as effective as longer-term usage of antibiotics in avoiding SSI. Short-term prophylaxis also leads to fewer problems and are more cost-effective in long term stays. Researchers believe that the ideal antibiotic prophylaxis procedures are to commence the antibiotic 60 minutes before the incision. It was once believed that prescribing antibiotics prophylactically to patients who had undergone

major surgery and had existing co-morbidities would decrease the risk of surgical site infections; however, more recent studies state that post-discharge prophylactic antibiotic use was not associated with decreased SSI risk. These results suggest that prolonged prophylactic antibiotic use should be avoided after surgery, given the lack of benefit and potential for harm (Olsen et al., 2022). The contradicting research articles found when researching post-discharge antibiotics use makes it hard to narrow down a standardized approach utilizing this practice to prevent SSIs. Further research must be done to solidify the use or discontinued use of this practice.

Variances in Diagnosis & Methodology

There are varying percentages of SSI rates from country to country. The observed variances may be attributed to several factors, including the use of different techniques, infection control measures, and changes in the patient population. Since postoperative stays are getting shorter in most industrialized countries, many SSIs do not appear until after patients have been discharged from the hospital. Somewhere between 12.8% and 84.4% of SSIs are found after patients have been discharged (Garcia et al., 2012).

Numerous SSI monitoring strategies have been proposed in the literature, each with its benefits and drawbacks. Active and passive approaches are employed to detect SSI, respectively. Infection control professionals use a passive strategy to go through patient records, test results, and conversations with ward staff to find cases of SSI. In an operational procedure, a member of the infection control team or the operating surgeon inspects the surgical site to look for signs of SSI. Pieces of each approach may be combined to create a new program or advancement.

Every ambulatory center, private practice or hospital may use a different tool for surgical site infection diagnosis and grading. This can cause discrepancies when trying to distinguish the rates of infections and how they present on diagnosis. While the Center for Disease Control and

Prevention (CDC) is the most prevalent tool for surgical site infection (SSI) diagnosis, ASEPSIS and Southampton scoring methods have been speculated to be more sensitive according to an analysis conducted by Campwala et al. (2019). The ASEPSIS scoring system classifies scores 21 to 30 as minor SSI, 31 to 40 as moderate SSI, and scores greater than 40 as severe SSI. The ASEPSIS scoring system demonstrated much better reliability than the CDC scoring. The ASEPSIS score factors in the percentage of the incision that is affected by serous exudate, erythema, purulent exudate, and/or separation of deep tissues into scoring (Campwala et al., 2019).

Evidence Base that Supports Implementation

To validate the choice of practice change proposed in the current evidence-based practice, taking the literature on this topic should be considered. Appendix B highlights the top ten literature based on both quality and level of evidence. The limitations and strengths were also considered as were the results. Using Ackley et al. (2008), Levels of evidence guide (Table 1), ten articles with the highest level of evidence (I-IV) and relevancy were selected for this project. Assessment of the literature reviewed places an emphasis on knowledge of risk factors associated with surgical site infections (Yang et al., 2020 (Level I); Korol et al., 2013 (Level II)), patient involvement and education or comprehension of discharge materials and self-care (Edmiston et al., 2014 (Level II); Butler et al., 2012 (Level II). In combination with clinician knowledge of existing risk factors and providing patient specific education, understanding that cost effectiveness and accessibility of telemedicine regarding incision and patient surveillance was emphasized in a Level IV study (Sathiyakumar et al., 2015). Both qualitative and quantitative studies exist in the literature for supporting the implementation of the project.

Kaur et al. (2017) found that the most effective strategy for decreasing these infections is a targeted and ongoing training program for direct patient care professionals. Direct patient care employees have been singled out as an essential part of the infection-monitoring puzzle. The nursing staff at a clinical facility is the frontline provider of care for patients at risk of adverse outcomes. SSIs hurt the patient's quality of life, although elective vascular surgery is conducted to enhance that same quality of life. Surgical site infections (SSIs) have grown in the clinical context for patients undergoing vascular surgery, as was previously reported. Different procedures, readmission soon after surgery, and the requirement for specialized nursing care after discharge are all linked to postoperative wound infection.

Studies have shown that 30% of patients undergoing vascular surgery develop wound problems, costing the healthcare system about \$10,500. The patient's share of the rising costs is not reflected here. Compared to the national average of 15% for all surgical operations, the readmission rate for elective vascular surgery is roughly 24%. The comorbidities associated with vascular illness continue to raise the risk of infection in these patients, despite the growing popularity of endovascular approaches to vascular intervention. The patient's health and life are in jeopardy due to SSIs. If healthcare providers lower the percentage of patients readmitted within 30 days, they can boost patient satisfaction and save costs without compromising quality.

Keeping this data in mind, it's critical to devise a method for lowering the rate of SSIs in the vascular environment. Everyone who has a vested interest in the change's outcome or is directly impacted by it is a stakeholder. Any doctor or other medical professional who is asked for input is considered a project stakeholder.

An article written by Anderson (2014) highlights all the different measures and evidence-based practices that have been used to help decrease SSIs. This article mentions several core SSI

prevention strategies that have been promoted by the Surgical Care Improvement Project (SCIP), including the appropriate choice and timing of antimicrobial prophylaxis, avoiding shaving surgical site hair, maintaining perioperative patient normothermia, and controlling perioperative blood glucose. During the past ten years, most providers associated with quality improvement and surgical improvement programs in the United States have become familiar with the recommended SCIP proposals. Providers across the nation are placing great emphasis on improving staff compliance with these recommendations because rates of performance on SCIP measures now also affect hospital payment under the Centers for Medicare & Medicaid Services Value-Based Purchasing Program (Anderson, 2014).

The SCIP initiatives include:

- Prophylactic antibiotics should be received within 1 h prior to surgical incision
- Prophylactic antibiotics should be selected for activity against the most probable antimicrobial contaminants
- Prophylactic antibiotics should be discontinued within 24 h after the surgery end-time
- euglycemia should be maintained, with well-controlled morning blood glucose concentrations on the first two post-operative days, especially in cardiac surgery patients
- hair at the surgical site should be removed with clippers or by depilatory methods, not with a blade
- urinary catheters are to be removed within the first two post-operative days
- normothermia should be maintained peri-operatively

Of the above-mentioned initiatives, preoperative therapy including shaving are no longer considered beneficial in reducing SSI rates (Anderson et al., 2014). In hospitals with nearly 100% SCIP compliance there are still occurrences of surgical infections. There are several evidence-based approaches that go beyond the recommendations of SCIP. These methodologies include optimizing antimicrobial prophylaxis dosing, preparing the colon with mechanical bowel preparation and oral antibiotics, optimizing tissue oxygenation, and using a surgical safety checklist (Anderson, 2014).

The World Health Organization (WHO, 2019) created a 19-item surgical safety checklist to increase adherence with best practices. There are approximately forty items on the checklist that are separated into three areas: sign in, time out, and sign out. During the time out period, the surgical team confirms that prophylactic antibiotics were administered appropriately or that antibiotics were not required for this surgery. It has been proven that the use of the WHO checklist improves surgical outcomes. A multi-center quasi-experimental study conducted in eight countries demonstrated that use of the WHO checklist led to a 50% decrease in rates of SSI and death (Anderson, 2014). These findings have been confirmed in subsequent single- and multi-center quasi-experimental studies (Van Klei, et al., 2012).

Remote wound surveillance and assessment offers a solution to private practice and ambulatory providers looking for an insight in post discharge information. While the use of telemedicine and phone interviewing has been widely used in other specialties, there lacks implementation in the surgical world. The Collaborative for Surgical Site Infection Surveillance (CASSIS) project conducted in 2022 included data from multiple hospitals on patients being discharged after surgery. A patient communication preference survey showed that 38% of patients prefer a follow-up by telephone or telehealth, 19% by e-mail, 14% via a text link, 7%

postal questionnaire, 7% any app, 4% outpatient appointment & only 2% preferred only access to an online portal.

The actual response rates for post-discharge surveillance showed that telephone/telehealth follow-up was the highest responding rate, followed by a text link to a secure patient platform (CASSIS, 2022). Post-discharge surveillance data can be crucial to SSI rate reduction. Establishing data on compliance for the different methods of post-discharge surveillance and leveraging patient preference is an important step in the design and planning of quality improvement (Dixon-Woods et al., 2012). The availability of video conferencing has also helped provide a visual aide for providers when attempting to identify potential SSIs via telehealth.

Nguhuni et al (2017) found that telephone surveillance had moderate sensitivity (i.e. SSI were correctly identified) and high specificity (i.e. non- SSI were correctly excluded) when compared with the ‘gold standard’ of a direct clinical review. There are currently significant gaps in knowledge about SSI rates after primary discharge and how to best capture the information for better practice implementation. By utilizing technology and creating a quality improvement program that allows providers structured insight and preventative evidence-based practices can help bridge the gap that exists.

Emmett (2020) details how mobile devices and internet connectivity can facilitate early diagnosis of infections and other symptoms/signs. With internet, the patient may be able to transmit pictures of the surgical site to the provider for examination. While not everyone has smart devices or internet accessibility, it is now a more common modality because of the COVID-19 pandemic and the influx of telemedicine system integration. This access to internet

and providers more readily allows for continuous education to the patient on what they should be looking for or what is a reportable symptom.

Costs Associated with SSIs

It is no secret that the costs associated with post operative surgical infections are high. The proposed project would follow a virtual surveillance structure, which would be more cost effective for the patient and is associated with cost reduction for re-admissions. One study noted that phone surveillance was more cost-effective than outpatient clinic surveillance. Compared to inpatient surveillance, the outpatient clinic method costs USD 15.6 per detected SSI, whereas the phone method costs only USD 4.6 (Abu-Sheasha et al., 2020). This study also mentioned that in both phone and outpatient/clinic surveillances, the risk of SSI was independent of loss-to-follow-up. However, the higher rate of infections among clinic attendees raises the suspicion that the incidence of SSI estimated by this form of surveillance could be biased upward. Phone surveillance was reliable with high sensitivity and specificity (Abu-Sheasha et al., 2020).

The overall cost of SSIs fluctuates from case to case, due to the severity of infection and the site. An estimated average cost of an SSI can be more than \$25,000 to \$90,000 for prosthetic implants (Emmett, 2020). SSIs cost the healthcare system anywhere between \$3.5 and \$10 billion annually and it is found that approximately 60% of all SSIs are preventable (Emmett, 2020). The proposed project uses this literature and evidence to help contribute to the reduction of costs associated with surgical site infections. It is worth noting that while cost is an important factor, it is not the main goal of this project rather an important factor that must be acknowledged.

Limitations of the Research

Although the evidence base research and articles provided in this literature review does provide plentiful support for constructing and implementing the quality improvement project, there are limitations to the research that should be considered when trying to implement any changes to policies and practice. Most of the reviews and analyses include multiple approaches to SSI reduction collectively, rather than studying one approach at a time. It is difficult to distinguish exactly which approach creates the most change. These limitations can create roadblocks and may be significant but there are positive correlating changes that can be proven and duplicated with quality improvement practice changes that can directly impact patient care and experience.

The multicenter study conducted by Schweizer et al. (2015) reviewed a bundled approach to surgical infection reduction for the specific micro-organism that compromises many of the SSIs. This study included implementing staphylococcus aureus screening, decolonization, and targeted prophylaxis that was then associated with a modest, statistically significant decrease in complex *S. aureus* SSIs (Schweizer et al., 2015). This level II study showed limitation to a singular microorganism which cannot be applied in a broad evidence-based protocol for multiple organisms. However, in hand with this limitation, there are also Level I systematic reviews that highlight both *S. Aureus* and MRSA as the main causative bacteria for SSIs.

More current information on antibiotic resistance would significantly improve the reporting of cost and effectiveness in infectious disease. Specifically, there is a difference between trial-based studies, which are inextricably linked to a trial and often incorporate some of the economic variables, and model-based studies, which gather data from a range of sources and put it into a health-economic model. This study aims to provide new information from trial-based

and model-based costing studies and to analyze the methodologies employed in economic analyses of prophylactic antibiotics for the prevention of SSI. This study not only details the local epidemiology of SSI-causing bacteria, but also offers a critical analysis of the publications included in the study (Purba et al., 2018).

Implications for Quality Improvement

It is worth noting that there is a grand issue with surgical site infections. As a potential entry point for germs from outside the body, an infection at the surgical site delays the healing process and poses an immediate risk to the patient (Berrios-Torres et al., 2017). All phases in surgery are crucial for reducing the risk of infection. Incorporation of the literature included in this review can provide a foundation to support the quality improvement project that will directly affect patient outcomes and experiences. It is noted that the education provided to practitioners can help emphasize the importance of following evidence-based guidelines to reduce an existing issue in practice. Although most research supports a multifaceted approach, the creation of a quality improvement program can be utilized and created in steps utilizing the evidence presented in this review.

The data suggests that changes do occur after education and implementation of such infection control/prevention programs. It is not commonly seen within private practices or in ambulatory settings as a collective. Most studies highlight the positive changes made with implementation of such programs within hospital settings. However, the changes found in those settings are significant enough to warrant implementation within all practices where a patient may present with a surgical site infection. The National Wound Care Strategy Programme (NWCSP, 2022) are calling for crucial attention to reduce the risk of SSIs and surgical wound

breakdown through multidisciplinary teamwork. The emphasis is currently on early identification and prompt and appropriate action.

Having information and proven research to help create a foundation for practice change shows the need for Doctorate of Nursing Practice students to continue to look for improvement opportunities and to search for potential improvements where patients benefit. Through education & program implementation, it is expected that provider knowledge will increase and that the practice change will decrease surgical site infection rates within private practice orthopedic patients. This modification should create a snowball effect of changes that will positively impact hospital re-admission rates, patient experience, patient experience with post-surgical pain, and overall reduction of infection related complications.

Synthesis of Literature

Factors that have been linked to surgical site infections (SSIs) include but are not limited to age, timing and length of antibiotic prophylaxis, duration of preoperative stay, preoperative shaving, diabetes, nicotine use, dietary condition, colonization with different microorganisms, use of drains, altered immunological system, and other aspects of the operation itself. These factors have been linked to SSI in some research but not others. The prevalence of specific risks may be attributable to methodological variances and regional variations in risk variables. Factors that may increase or decrease a patient's risk of surgical site infection include operation duration, wound type, antibiotic prophylaxis administration, incision drainage, and preoperative shaving.

In the global analysis conducted by the WHO, young age was determined to be a risk factor. Still, in countries with greater access to healthcare, only advanced age was associated with increased mortality. It is still being determined whether additional factors often linked to SSI in industrialized nations also constitute a risk in underdeveloped countries. Antibiotic

prophylaxis in aseptic surgical operations, and which antibiotic agent should be used, if any, are topics of constant debate. It is well-documented that hospitals in developing nations see more patients overall and have a higher infection rate among those patients. It is assumed that a lengthy preoperative stay in a hospital increases the risk of infection.

The use of technology advances such as telehealth opens the door for post-discharge patient surveillance to monitor specifically for signs or symptoms of surgical site infections. There has been a tremendous shift in the recent decade toward patients' relying on social media and other contemporary internet-based resources, with sites like Facebook, Twitter, YouTube, and blogs emerging as new and crucial informational centers in the healthcare business (Butler et al., 2012). Creating an accessible virtual quality program for patients who have elective surgeries in privately owned surgical centers rather than hospitals can help educate patients and decrease the risk of surgical infections.

Because of the potentially fatal consequences of delaying treatment for SSIs, prompt action is required. The underlying issue is that healthcare facilities in some regions of the country are inadequate to stop the spread of infectious diseases. Lack of regulation regarding the number of visitors allowed at a patient's bedside before surgery is directly responsible for the high rate of Surgical Site Infections. Because the skin is a host for many other microorganisms, it is home to many potentially infective organisms. The presence of the infectious microorganisms and the clinical symptoms of SSI must be confirmed for an accurate diagnosis and description. Surgical site infections (SSIs) commonly affect the outer layers of tissues, but only a minority of severe infections progress through to the inner layers.

In most cases, SSI-related infections appear within the first 30 days after surgery, typically between days 5 and 10. However, when it comes to prosthetic implants, the effects of

SSIs on deeper tissues may not become apparent until a great deal of time has passed. Even though the rising tide of antibiotic resistance poses new therapeutic challenges for doctors, most antibiotic prescriptions are still written for prophylaxis against SSIs.

Many hospitals have made reducing SSIs a key priority. Guidelines for lowering the likelihood of SSIs are included in the Joint Commission's National Patient Safety Goals for hospitals and ASCs. The CMS's Hospital Compare website displays SSI rates and other surgical quality indicators that hospitals are mandated to report to the federal government. Infections at surgical sites may now be effectively avoided. AHRQ's Partnership for Patients project results show that the national SSI rate reduced by 16% between 2010 and 2015, resulting in significant patient benefits (including preserving many lives) and significant cost savings.

Chapter III

Purpose/PICO Clinical Questions/Objective

The following PICO question was proposed:

- In healthcare providers working in a private orthopedic office, does the use of a surgical surveillance educational program regarding surgical site infection reduction increase knowledge as compared with knowledge before the educational intervention?

The PICO components that make up this question can be further broken down as follows:

- P (population): the target population are the clinicians and providers caring for the post-operative orthopedic patients.
- I (intervention): Education on steps for a surgical surveillance program that involves a multi-level approach utilizing knowledge on risk factors for planning, implementation

of evidence-based practices and a follow up visit that is focused on infection prevention.

- C (comparison): Comparing the sample baseline knowledge scores from implementation using the pre and post exam analysis of provider's knowledge.
- O (outcome): Increased provider knowledge on using surgical surveillance and applying it in practice.

Based on this purpose and PICO clinical objective, the following SMART goals for the project are proposed:

1. By late February 2023, develop a standardized education program that can be utilized for every kind of surgery (both open and laparoscopic).
2. By March 2023, have one change agent within the stakeholders who is familiar with the education on the surveillance program.
3. By May 2023, have the results of the pre and post exam and the analysis of the implementation.
4. Increase provider knowledge by at least 10% from the baseline percentage by July 2023, from implementing an evidence-based education program.

Chapter IV

Definition of Terms

Two terms relevant to this quality improvement project were identified for review: surgical site infection and telehealth. The CDC and The National Healthcare Safety Network (2021) collaborated to define SSI as any infection at the site of surgery. SSI may be either superficial or deep and can also be organ/space related. For the purposes of this project, a surgical site infection is any surgical incision that is infected. The New England Journal of

Medicine (2018) defines telehealth as the delivery and facilitation of health and health-related services including medical care, provider and patient education, health information services, and self-care via telecommunications and digital communication technologies. The term telehealth in this project refers to any communication with the patient that is not in person, including but not limited to, phone call, live video conference, text message, etc.

Chapter V

Conceptual Underpinning and Theoretical Framework of the Project

The FADE model is being used as a theoretical framework and methodology for program structuring and maximizing opportunities. This model is composed of five key concepts: (a) *focus* – in this step, we define and verify the existing process and identify the areas that need to be improved, (b) *analyze* – in this stage, the problem is defined based on prioritization and then data is collected to establish a baseline through analysis, (c) *develop* – this phase is where an action plan or improvement plan is proposed to solve the problem, (d) *execute* – This step is a pilot implementation of the proposed plan, (e) *evaluate* – this final step is where the effects on the problem are monitored and closely documented (Aichouni, *et al.*, 2021).

Focus

Define the process or area that needs improvement - The focus of this project was improving provider knowledge and confidence regarding infection prevention by implementing a quality improvement education on surgical surveillance.

Analyze

Data collected and analyzed - A needs assessment based on a SWOT analysis revealed the need for a standardized education process where participants are both guided and followed up with specifically regarding preventing infections and evidence-based practices.

Develop

Create a plan of action – An evidence based surgical site infection reduction education program was developed based on components of the WHO Guideline for Safe Surgery (2009) and current meta-analyses and systematic reviews. The project director conducted an education session for both the orthopedic surgeons, midlevel practitioners & other staff. In this new education program or process, the project director is responsible for the results of both the pre and post survey results and comparison.

Execute

Plan implementation – The education session is conducted during an hour session with the appropriate staff. The new prevention education program will be highlighted and presented at this time utilizing a PowerPoint presentation. The post education survey is then distributed and answered anonymously by the participants four days later.

Evaluate

The education program is monitored – the project director will collect data from the pre-education survey, the post-education survey and the fictional infection reports used for examples. The project director is conducting the initial education session for practitioners, following up with stakeholders, ensuring all survey answers are received and performing data collection and analysis utilizing a baseline percentage of a current fake SSI report to compare with after education program implementation to measure rate of theoretical reduction, if any.

Chapter VI

Methodology

Settings and Participants

The clinical site where the quality improvement project is being implemented is a private orthopedic & sports medicine practice. There will be 10 participants selected by way of volunteering. The participants will include only staff from the office and no patients.

Organizational Assessment

This quality improvement project focuses on creating a standardized education program that focuses on infection control as a multi-faceted problem rather than a problem at a singular phase within surgery. It is imperative to highlight that this project will focus on the understanding of evidence-based practice changes within the post-operative/post-discharge period and how this education implementation affects provider knowledge and comfort. However, there are implications in every phase that can contribute to infection rate change and provider knowledge.

A systematic review by Ng et al. (2021) emphasizes that telemedicine modalities are a feasible option for post-operative follow-up, especially in the identification of SSIs. Because this approach has not been studied in depth, it is recommended that telehealth be used as an augment rather than an alternative when it comes to general post operative follow-ups. For this project, it is imperative to note that the educational surgical surveillance program is not an alternative to regular follow ups but a supplement to help decrease infection rates.

Primary DNP Project Goal

The current state at the immersion site is that there are increased incidents of surgical site infections. The primary aim of this research project is to increase provider's understanding that creating and adopting a program that both decreases the occurrences of infections and is standardized is both beneficial and supportive for future patients and current providers. Additionally, it strives to increase the provider's tools so they may use evidence-based practices to help improve patient outcomes. According to Cook *et al.*, (2014), postoperative education that is personalized to the patients' surgical and medical conditions and to their experience has the potential to improve patient outcomes. By utilizing newer modalities such as telehealth or video conferencing, the door for education using varying learning styles or preferences and even languages enhance the consistency of information and education being relayed to patients on how to care for & what to look for with their surgical sites. Technology-supported education can permit for individualization of content, which is linked to improvements in patient outcomes (Cook *et al.*, 2014).

There are currently no standardized surveillance education programs or pre-operative guidelines in place for infection prevention. According to the WHO's Guideline for Safe Surgery (2009), effective surveillance systems and feedback to surgeons on their infection rates have been shown to improve the prevention of surgical site infections. To create a surveillance method that is both evidence based and easy to teach/follow, the WHO (2009) recommends the following principles to be considered:

- To maintain accurate, efficient, confidential data collection;
- To provide data on final infection rates stratified by multivariate risk for each surgeon and patient;

- To use clear, consistent definitions of infection; and
- To use standardized post-discharge follow-up protocols and proper maintenance of data.

The goal of this project is to improve provider knowledge and potentially patient outcomes by implementing a standardized education program that provides clinicians and their staff with the appropriate and adequate resources and information needed to create change in current practices. Proper execution of the education may result in reduction of surgical site infections and improve patient outcomes.

Description of Approach and Project Procedures

Utilizing a list of fictitious patients, a mock surgical site report & surgical infection examples, the proposed educational program for providers strives to increase the provider's knowledge tools so they may use evidence-based practices to help improve patient outcomes. Providers will have the choice to opt-out of the surgical surveillance educational training. All qualifying staff will receive an invitational email to participate & the pre and post tests will include the collection of their demographics. The demographic data collected includes gender, race, age group, and average length working in the medical field. After staff consent to participate, the data collection that is pertinent to this quality improvement project will be collected and analyzed through the education implementation.

Step one is where all qualifying participants are selected for the education. During step two, the participating staff will be sent a pre-test where relevant questions are asked and answered anonymously. Utilizing the scores gathered from step two, step three will be the educational presentation on the importance and need for a surgical surveillance program and how

to implement it appropriately. Step four is the post-test and analysis of the post-test scores to check for success of the educational program.

This quality improvement project focuses on creating an educational program that focuses on infection control as a multi-faceted problem rather than a problem at a singular phase within surgery. The lack of such an evidence-based guideline or program in place may result in more healthcare issues than just surgical site infections. It is worth mentioning that ambulatory centers and private practices lack standardized surveillance programs that would assist in lowering infection rates. In that sense, this project proposes the creation of a quality improvement program that would be used in private practices and ambulatory centers to improve patient outcomes and lower infection rates.

Protection of Human Subjects

To protect human subjects, this quality improvement project includes a variety of safety measures. First, all chosen participating staff at the immersion site were asked for participation consent and that they understand there are no risks associated with participating in this DNP project. Second, all program participants during the trial period will be given the contact information for the primary investigator and are allowed to always ask questions or for clarification. Third, all staff participants are allowed to withdraw from the project at any time for any reason; the reason does not have to be disclosed to the investigator. These methods are in place to protect the privacy and confidentiality of all participants.

Data Collection

Data collection will occur by way of fictitious infection rate reports that are done for the immersion site. The fabricated report analysis will be done where surgery type, number of day(s) after surgery when symptoms or signs are first reported, follow up visit date

(presented in number of days following discharge), and percentage of infections to total surgeries completed is recorded. Following the implementation of the education of the program and the post education survey, a secondary sample infection report analysis will be conducted utilizing the same factors. This will then show a difference in terms of percentage which can then be assumed is due to the education provided.

Data Management & Analysis

All data being utilized in this project is to be stored in a password protected laptop to which only the author will have access to. A hard copy and digital copy of the education program presentation and surveys will be stored safely with the primary investigator. Data will be analyzed via Excel. All data collected for this project will be held for 5 years after the completion of this project and will then be permanently deleted from the computer's hard drive.

The American College of Surgeons (2022) offers a free, online surgical risk calculator that gives each patient a risk score depending on multiple risk factors. The factors used to determine the score include:

- Procedure (as defined by the procedure's registered CPT code)
- "Are there other potential appropriate treatment options?"
- Age Group
- Sex
- Functional Status
- Emergency Case
- ASA Class
- Steroid use for chronic condition
- Ascites within 30 days prior to surgery

- Systemic Sepsis within 48 hours prior to surgery
- Ventilator dependent
- Disseminated cancer
- Diabetes
- Hypertension
- Congestive heart failure in 30 days prior to surgery
- Dyspnea
- Current smoker within 1 year
- History of severe COPD
- Dialysis
- Acute Renal Failure
- BMI calculation

ACS Risk Calculator, 2022

The outcomes from the data input are then presented in percentages for different risks. These risks include, but are not limited to, surgical site infection, sepsis, UTI, DVTs, etc. For the purpose of this education program proposal, we will only utilize the risk percentage associated with surgical site infection. While this calculator is intended for in hospital patients, it can also be utilized for outpatient surgeries. By adding this tool to the surgical surveillance education bundle, it can provide the clinician with personalized education data for the patient while also analyzing the risks associated with the procedure for that patient. This tool helps personalize the approach to preventing infections.

Data analysis for this project will include a score report difference in survey answers and a report for before and after from the made-up infection reports for sampling. The rule to be used

for calculation is as follows: subtract the new incidences from the original pre-implementation incidences, and then dividing the result by the original incidences.

- $$= (\text{baseline infection incidences} - \text{infection incidence after program implementation}) / \text{baseline infection incidences}$$

Assessment of changes in the scores will provide theoretical insight into whether the program was successful in reducing rates of infections or not. This report is part of Appendix F.

SWOT Analysis

A SWOT analysis of the project's strengths, limitations, opportunities, and potential dangers was used to identify any factors that may influence the project's implementation. Teoli et al (2022), describes a SWOT analysis as a strategy tool that utilizes both internal and external considerations to build upon improvements and their potential threats. By utilizing this approach and identifying where there are potential barriers and opportunities for patient care improvement within this project, it is imperative that each factor is independently highlighted and reviewed. The facility has experienced nurses, medical doctors & midlevel practitioners that can help with the implementation process.

Identified strengths within the practice include the accessibility of pertinent information for this project. Vital material is collected through the Infection Control team at the ambulatory surgical center to provide guidance on where there are missed opportunities for policy change and patient education or understanding. There are also strengths in numbers; there are plenty of qualified staff who are willing and ready to participate in the execution and follow through that such a program would require. The office has a well-qualified medical billing team who is also willing to participate in terms of getting the correct CPT and ICD-10 codes in place for

reimbursements through the healthcare insurances to alleviate the financial burden these visits may have placed the patients under.

There is currently no surgical infection prevention specific follow up programs or education protocols in place within the private practice to ensure the patients are adhering to the pre and post operative instructions or to ensure that they comprehended the instructions that were given to them. At the present time, there is a 3-5 day follow up period post operatively for ambulatory patients and the visit is general in nature, with just a few basic questions referencing the surgical incision and knowledge on signs or symptoms related to SSIs. The first 15 to 30 days after surgery are vital for preventing infections.

There is also no one assigned within the stake holders or office staff to oversee such a protocol or program at this time. There are currently two mid-level practitioners, two orthopedic specialists, a medical assistant, three physical therapists, and two administrative members all on staff. In creating this SSI prevention education program, the leadership role will have to be assigned to a change agent. Patient and staff education on proper wound care techniques & symptoms are crucial for a successful quality improvement project. Standardizing the approach to the education provided to patients & standardizing the usage of WHO surgical safety checklists is also imperative in keeping track of future trends within the practice and within the project's future success.

Lastly, a potential weakness is time management. Standardizing the approach to and the deliverance of the follow-up visits can help potentiate the amount and quality of time spent on the wound care focused visits. Building this project will enable the practice to structure their office days, prioritize patient loads and patient experience while also maximizing time management.

Chapter VII

Results

The results from this project were formulated using Excel. The data analysis starts with characteristics of the sample group to compile demographic data of the participants. A total of 10 staff participated in this project, and the demographic data for the sample is summarized in Table 1. The data indicated that the sample was comprised of primarily male staff ($n = 7$, 70%), between the ages of 24 and 34 ($n = 6$, 60%), and of Hispanic descent ($n = 10$, 100%). The average years working in the medical field was 16.3 years with a standard deviation of 15.4.

Table 1

Demographic Characteristics of the Sample ($n = 10$)

Demographic Variable	Result
Gender	
Female	$n = 3$ (30%)
Male	$n = 7$ (70%)
Age Range	
24-34 Years	$n = 6$ (60%)
34-45 Years	$n = 2$ (20%)
46-56 Years	$n = 2$ (20%)
> 57 Years	$n = 0$ (0%)
Race/Ethnicity	
White	$n = 0$ (0%)
African American	$n = 0$ (0%)
Hispanic	$n = 10$ (100%)
Other	$n = 0$ (0%)
Average years working in the medical field	16.3 years (SD 15.4)

Descriptive data was also utilized to evaluate the mean pre- and post-education knowledge scores of the staff who participated. Pre- and post-education comprehension scores were logged before and after the program education and the average scores were then formulated. Table 2 illustrates a comparative overview of pre- and post-test scores. Figure 1 then shows a bar graph comparing the pre-and post-education scores. Utilizing these visual aids, it is possible to note the significant difference in the scores and the how the education provided resulted in change. The mean score for pre- and post-education shows a vast difference, 7.2 and 9.3, a 29% increase respectively. Table 3 details all the individual scores and answers utilized for data analysis and score reporting.

Table 2

Pre- and Post-Education Knowledge Scores

	Pre-Education	Post-Education
Mean Score	7.2	9.3
Standard Deviation	1.751	0.823

Table 3

Statistics used for Data Analysis

Years in medical field	1	3	4	4	5	11	28	39	32	36
Pretest scores	8	10	9	5	7	5	7	8	5	8
Post-test scores	8	8	9	9	9	10	10	10	10	10

Figure 1

Pre- and Post-Education Knowledge Score Comparison (N = 10)

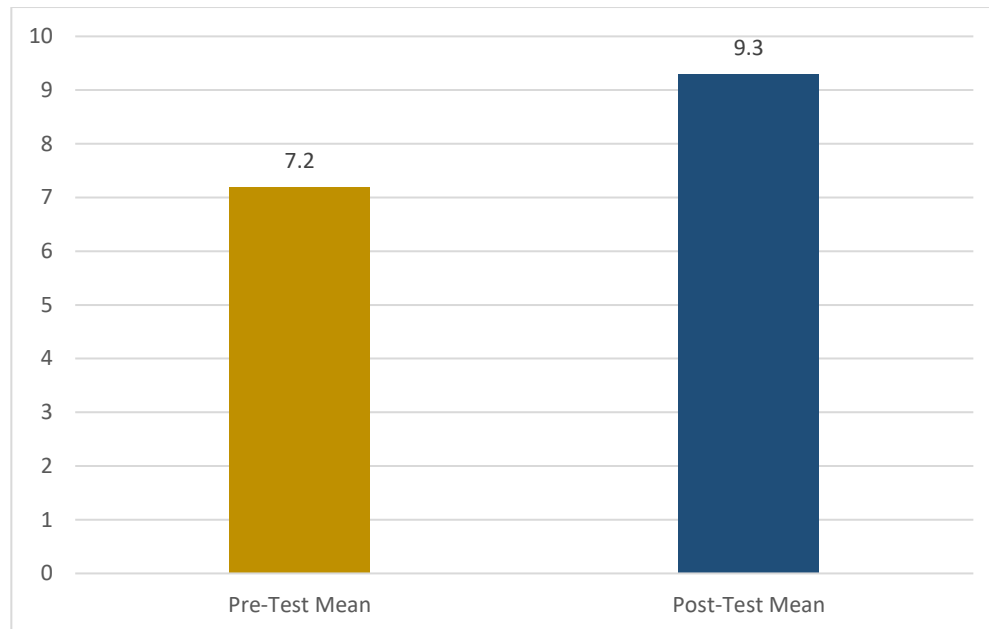


Figure 1 helps highlight the increase in knowledge from the education provided. Conversely, it fails to prove statistical significance. To assess the statistical significance of the collected data, a paired *t*-test was performed. After analyzing the results of the paired *t*-test, a decision was made to use the *p*-value for the one-tailed *t*-test as the PICO question does assume that there will be an increase in post test scores and potentially improved patient outcomes. A one-tailed test was then conducted which produced a value as $p < 0.000$. The significance level, or alpha value, of 0.05 indicates there is a 5% risk of concluding that a difference exists when there is no actual difference. When comparing the *p* and α values, it indicates that the results of the posttest were indeed significant and were caused by educational intervention and not merely by chance.

Chapter VIII

Discussion

The outcomes of this quality improvement practice prove that the implementation of an education program does in fact positively affect the provider's knowledge in preventing surgical site infections. Surgical site infections are one of the most common complications after orthopedic surgeries because of the complexity of orthopedic surgery and the use of implants in orthopedic surgery all contribute to the increased risk of SSIs (Yang et al., 2020). The project sought to implement a change based on evidence-based research and increase the provider knowledge and confidence around assisting patients with the reduction of surgical site infection risk.

Utilizing education to teach providers on the importance of all the factors that make a surveillance program, like telehealth follow ups, can improve and impact patient outcomes. A study conducted by Mehtar et al. (2020) highlights that many SSIs occur after a patient has been discharged, it is not uncommon for a patient to seek treatment from a local practitioner instead of traveling back to the original surgical care facility. Subsequently, follow-up surveys that collect information about patient health outcomes utilizing telecommunication devices have been recommended and successfully used in various countries (Mehtar et al., 2020).

The PICO question presumed that provider knowledge would increase following the provided education. This outcome was accomplished. The results from the implementation showed that the mean scores increased by 2.1 and was noted as a statistically significant finding following the comparison of pre- and post-intervention scores through a paired *t*-test. The results also proved that the findings were improved as a direct result of the education and not by mere chance. Based on the results acquired, it is possible to now answer the PICO question that served

as the groundwork for this project. Specifically, the PICO question was: In healthcare providers working in a private orthopedic office, does the use of a surgical surveillance educational program regarding surgical site infection reduction increase knowledge as compared with knowledge before the educational intervention? After reviewing the data and carrying out the implementation of this project, it is evident that the knowledge base and confidence in providers did increase.

Limitations

The limitations that exist in this project should be utilized as a steppingstone for further investigation into how education on preventative programs truly impacts both the provider's knowledge and the patient outcome. This project was conducted in a single private office and used a very small sample size/number of participants ($N = 10$). The selection of the participants was based on volunteers rather than random selection, which created a convenience framework and cannot correctly represent general population. Another limitation in this study is the lack of variation in population race. All ten participants were Hispanic; this again, leads to a lack of general population representation and limits the application of data. The project was also limited by a lack of time for implementation follow up. While the focus of this project was the education and the provider knowledge, there is no long term follow up on information retention and/or practice change. The presented p-value does indicate that the change in knowledge for providers who participated in the project was caused by something more than chance, without a direct control or comparison group, it is not possible to state with absolute certainty that increased knowledge could be solely attributed to the educational program.

Implications for Advanced Practice Nursing

Because surgical site infections are so common in all specialties and within all areas of nursing it is imperative that ARNP and their counterparts all become familiar with evidence-based programs that can help decrease the incident rate of infections. The education of advanced practice nurses should go beyond the lessons from the master's curriculum and more specifically towards their client population. Surgical surveillance programs can be tailored to meet the needs of the patient population, whatever their needs may be. The flexibility allowed through the education provided is pliable enough to fit all kinds of providers and still positively impact patient outcomes.

Despite the previously mentioned limitations, this project utilized evidence-based methods and educational points that have already been proven to be effective when utilized correctly. This project can be utilized to guide other educational, leadership and nursing implications in preventing surgical site infections through surveillance program education. The project addresses the need for continuous and developing education on best practices for healthcare providers. This includes understanding how to utilize resources like the American College of Surgeons Risk Assessment tool, patient education on the importance of pre-operative showers, glucose checks and evidence-based practices on how to assist patients in preventing infections. This project should serve as the groundwork for further development of provider education and surgical surveillance programs.

The inferences of this project also extend into nursing leadership. This project was created based on a need in the practice. This need for change to improve patient outcomes and reduce infection rates brought together a group of people who ultimately all acted as change agents to contribute in some way towards the development and continuation of education.

Practice change cannot successfully occur without all the moving parts from administration to advanced practice nurses and physicians. Understanding the vitality behind consistent education and standardized approaches is essential to the core of projects like this one that affect patient outcomes.

Conclusion

The information gathered and analyzed throughout this project demonstrates how the use of evidence-based education to increase provider knowledge on the importance of a surgical surveillance program and how it does indeed create positive change. Participants enrolled in this quality improvement project did show an increase in knowledge and in confidence on having conversations about surgical surveillance and providing the necessary education. By implementing and continuing the education provided in this project, there will be a snowball effect. Practice change will improve patient outcomes, reduce costs for both providers, patients, and insurance programs, and improve overall population health within the community. It is safe to state that making changes based of evidence-based research to enhance patient results is the best approach to active growth and change.

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Appendix A: Recruitment Letter**A quality improvement project: Reducing Surgical Site Infections in Post-Surgery Orthopedic Patients by Implementation of a Surgical Surveillance Program**

To Whom It May Concern:

I am conducting a research study on reducing surgical site infections in post-surgical orthopedic patients by implementation of an educational surgical surveillance program. Participation will take approximately 90 minutes total. The primary goal of this DNP project is to create an educational program that both decreases the occurrences of infections and offers providers with instruction on utilizing best practices to increase patient outcomes. If you are interested, please contact the investigator and further instructions will follow. Only 10 participants will be selected for participation. There are no known risks involved in this research and all pertinent information will be kept confidential.

If you have any questions, please feel free to contact me.

Jennifer Peralta, MSN, ARNP, FNP-BC

Jpera010@fiu.edu

786-332-7676

Appendix C: IRB Approval Letter**MEMORANDUM**

To: Dr. Eric Fenkl

CC: Jennifer Peralta

From: Carrie Bassols, BA, IRB Coordinator *ceb*

Date: March 21, 2023

Proposal Title: "Reducing Surgical Site Infections in Post-Surgery Orthopedic Patients by Implementation of a Surgical Surveillance Program"

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #: IRB-23-0126 **IRB Exemption Date:** 03/21/23
TOPAZ Reference #: 112720

As a requirement of IRB Exemption you are required to:

- 1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
- 2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
- 1) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at <http://research.fiu.edu/irb>.

Appendix D: Demographic Collection & Pre and Post Tests

All data collection and test responses are anonymously reported. Questions in red are not graded.

Demographics:

Gender: Female____ Male____ Other____

Age: 24-34 yrs.____ 35-45yrs.____ 46-56 yrs.____ >57 yrs.____

How many years have you been working in the medical field? _____

Race/Ethnicity: White____ Black____ Hispanic____ Haitian____ Asian____ Other____

Pre/Post Test

1. The American College of Surgeons Risk Calculator give you a score 1 through 10 for patient risk.

True

False

2. Learning about a surgical surveillance program has been proven to be effective.

True

False

3. The following are important factors when considering reducing surgical site infections (**select all that apply**)

- A. Prophylactic Antibiotics
- B. Patient self-shaving of site
- C. Patient understanding of surgical site post operative care
- D. Physical therapy
- E. Blood glucose checks on only diabetic patients
- F. Patient showering morning of surgery

4. Scheduling post-operative Telehealth calls 24 hours after surgery with the patient is important

True

False

5. A laparoscopic trocar site is not considered a surgical incision and not a stab wound.

True

False

6. If one laparoscopic incision meets criteria for a superficial incisional SSI and another laparoscopic incision meets criteria for a deep incisional SSI, you would report one deep incisional SSI.

True

False

7. I feel comfortable educating my patients on preventing surgical site infections.

True

False

8. I have a resource on how to guide patients in preventing surgical site infections.

True

False

9. I feel prepared for conversations with patients on how to assist them in preventing surgical site infections

True

False

10. I feel confident caring for patients with the tools at my workplace to improve patient outcomes.

True

False

11. Antibiotic prophylaxis includes ensuring the patient receives an antibiotic _____ prior to surgery.

- A. 3 hours
- B. 30 minutes
- C. 5 hours
- D. 60 minutes

12. A pre-operative and post-operative glucose level of _____ would place the patient at an increased risk for surgical site infection.

- A. 200 mg/dL
- B. 180 mg/dL
- C. 90 mg/dL
- D. 190 mg/dL

13. An additional telehealth visit should be scheduled on day _____ for patients who show above average ACS risk and patients who had high glucose checks pre and post operatively (above 200).

- A. Four
- B. Seven
- C. Nine
- D. Ten

14. Men and women always have the same symptoms when developing surgical infections

True

False

Appendix E: Sample Surgical Site Infection Reports**INITIAL**

Type Of Surgery	
Laparoscopic	16
Open	2
Post-Surgery Surveillance/Follow up	
Yes	2
No	16
Infection Reported	
Yes	6 (34%)
No	12 (66%)
Infection Classification	
SWC1	4 (68%)
SWC2	1 (16%)
SWC3	1 (16%)
SWC4	0

FINAL

Type Of Surgery	
Laparoscopic	14
Open	4
Post-Surgery Surveillance/Follow up	
Yes	18
No	0
Infection Reported	
Yes	1 (6%)
No	17 (94%)
Infection Classification	
SWC1	1 (100%)
SWC2	0
SWC3	0
SWC4	0

*An 82.3% reduction in infection rates utilizing the education from the program is hypothesized utilizing sample reports.

Appendix F: Literature Table

Author/Year	Purpose/ Problem/ Objective/ Aims	Study Design	Sample (Setting)	Data Collection Measures	Results	Relationship to Project	Level of Evidence
Yang, et al. (2020)	To investigate the factors affecting surgical site infections (SSI) in patients undergoing orthopedic surgery.	Meta-Analysis	Clinical data from 25,954 patients	incidence rate and predictors of SSI in patients undergoing orthopedic surgery.	Risks: <ul style="list-style-type: none"> - Age > 60 years old - Chronic diseases - Diabetes - Hypertension - incision type from type I to type III Protective: <ul style="list-style-type: none"> - Age less than 18 - Foot surgery 	Defines what are protective factors and what are risk factors in terms of orthopedic surgery; the main location of the project implementation is orthopedic specialty	Level II
Ariyo, et al. (2019)	To summarize implementation strategies aimed at improving adherence to evidence-based interventions that reduce SSIs.	Systematic Review	The analysis included 124 cohort studies and 1 RCT.	searched the following databases: PubMed, EMBASE, CINAHL, Cochrane Library, and WHO Regional databases, including AFROLIB and Africa-wide information on EBSCO for articles published from January 1, 1990, through December 31, 2015.	76 studies (63%) described efforts to engage frontline staff as an important strategy to improve adherence with prevention measures. Also, 65 studies (54%) used some form of education to introduce the measures to frontline staff, compared to only 11% of studies that focused on patient education. Execution strategies to improve adherence were described by 108 studies (86%). In addition, 74	<ul style="list-style-type: none"> • Highlights the importance of education to both staff & patients. • Execution strategies such as quality improvement projects were mentioned or utilized in 86% of studies. • Shows relevancy and need in the implementation of a multifaceted quality improvement project 	Level I

					studies (59%) described evaluation activities.		
Schweizer, et al. (2015)	To evaluate whether the implementation of an evidence-based bundle is associated with a lower risk of S. aureus SSIs in patients undergoing cardiac operations or hip or knee arthroplasties.	Quasi-experimental before/after design.	20 hospitals in 9 US states participated in this pragmatic study	Rates of SSIs before and after implementation of bundled interventions	In this multicenter study, a bundle comprising S. aureus screening, decolonization, and targeted prophylaxis was associated with a modest, statistically significant decrease in complex S. aureus SSIs.	Layering an approach to SSIs proves to be effective. This study introduces the idea of bundle interventions which can set the foundation for an infection prevention surveillance program	Level II
Korol, et al. (2013)	The objective of this systematic review was to characterize risk factors for SSI within observational studies describing incidence of SSI in a real-world setting.	Systematic Review	328 titles published in 2002-2012; 57 were identified as relevant for data extraction	Median overall time of SSI symptoms, risk factors for SSIs, provider recognition of risk factors	risk factors for SSI were characterized as describing reduced fitness, patient frailty, surgery duration, and complexity. Recognition of risk factors frequently associated with SSI allows for identification of such patients with the greatest need for optimal preventive measures to be identified	Contributes to the idea that personalized patient education and follow up can reduce SSIs Median time of onset of SSI signs/symptoms is 17 days post-op (longer associated time with implantation of device). This sets the foundation of time for the proposed program	Level I

Purba, et al. (2018)	This review assessed the current research related to the use of antibiotics for SSI prophylaxis from an economic perspective and the underlying epidemiology of microbiological findings.	Systematic Review	20 eligible full-text studies that met our inclusion criteria	A literature search was carried out through PubMed and Embase databases from 1 January 2006 to 31 August 2017.	information from both trial-based and model-based costing studies could be considered in the clinical implementation of proper and efficient use of prophylactic antibiotics to prevent SSIs and antimicrobial resistance.	<p>Most common factor in private practice surgery is the inconsistent use of prophylactic antibiotics because of differing studies and patient costs.</p> <p>This study helps accentuate the use for proper use of prophylactic antibiotics that can help reduce costs long term and prevent microbial resistance</p>	Level I
Sathiyakumar, et al. (2015)	identify the impact of the physical status of the (ASA) on the 30-day readmission of patients receiving operative management of orthopedic fractures using the National Surgical Quality Improvement Program database.	Randomized Controlled Trial	total of 8761 patients	30-day readmission for the selected orthopedic surgical procedures	The ASA physical status proved the strongest predictor of 30-day readmission for the selected orthopedic trauma procedures. After controlling for age, gender, race, and medical comorbidities that were shown to be significant independent risk factors for readmission, ASA score continued to have a significant association on 30-day readmissions in the combined population	<ul style="list-style-type: none"> • Solidifies the ASA classification status as the strongest predictor for 30-day admissions. • Attaching this ASA score to all surgical patients can help further personalize post operative surveillance and help prevent SSIs • Is a strong predictor outside of the known risk factors that exist for SSIs 	Level II

Nguhuni, et al. (2017)	an observational cohort study to examine the sensitivity and specificity of telephone calls to detect SSI after discharge from hospital in comparison to a gold standard of clinician review.	Quasi-experimental before/after design.	374 women	The use of telephone interview as a diagnostic tool for post-discharge surveillance of SSI	25 SSI were diagnosed, of which telephone interview had correctly identified 18 infections; telephone calls did not incorrectly identify SSI in any patients. The overall sensitivity and specificity of telephone interviews as compared to clinician evaluation was 72 and 100%, respectively.	This study details the high sensitivity and specificity of SSIs diagnosed via telephone. It is both more accessible and efficient to see and diagnose SSIs via telehealth options in adjunct to traditional follow ups	Level IV
Bert, et al. (2017)	The aim of this study is the evaluation of the incidence rate of the SSIs in relation to the implementation of the bundle from January 1st to December 31st, 2012.	Quasi-experimental before/after design.	3314 surgical operations during the year 2012 from 37 hospitals	The already-established SSI surveillance, together with the systematic use of surgical bundles, can increase the quality of monitoring systems and lead to an improvement in health care quality.	the bundle resulted as a protective factor for the infection risk in colon surgery. In the hip surgery, the application of the bundle was not statistically associated to a decrease of the risk of infection.	This study shows that a bundle approach to SSI reduction in combination with existing SSI reduction protocols can decrease the rate of infection in hospitals.	Level I
Ng et al. (2021)	This review aims to assess the accuracy of using telemedicine in the diagnosis of SSI in post-surgical adult patients as compared to in-person assessments.	Systematic Review	A total of 1609 studies were identified	The primary outcome measure was the number of SSIs diagnosed using telemedicine modalities as a proportion of the total number of SSIs diagnosed	Telemedicine modalities are a feasible option for post-operative follow-up, especially in the identification of SSIs.	This review supports that post-operative follow up via telehealth should be used as an infection control specific augment to follow ups.	Level I

