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Preoperative Chlorhexidine Skin Preparation for Patients Undergoing Vascular Surgery

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Abstract

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BScN, University of Western Ontario, 2005

Project Submitted in Partial Fulfillment

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Abstract

In response to improving quality patient care, combined with the growing rates of surgical site infections (SSIs) in vascular patients, the need to explore current practice trends with current evidence has been identified. SSIs affect quality patient care and compromise patient safety. Empirical evidence has recommended the use of a chlorhexidine wash preoperatively to reduce SSIs. Despite this recommended practice, vascular patients were not receiving it in their routine plan of care within a hospital organization in southern Ontario. Guided by Lewin's theory of planned change, this project explored how the planning of a chlorhexidine preoperative surgical skin preparation protocol impacted progress toward improved care of vascular patients. The project was designed as a quality improvement project examining approximately 110 vascular surgical procedures over a 1-month period and staff surveys that were provided to staff in the preoperative (n = 88), same day surgery (n = 68), and inpatient (n = 47) units. These data were analyzed and demonstrated a reduction in vascular SSIs from 4.9% pre-implementation to 2.8% 1-month post-implementation. Major themes generated from the staff surveys demonstrated the nursing staff had a good understanding of the content that was presented in the in-service provided. These findings have implications for social change by highlighting the benefits of incorporating evidence in to practice and further informing the preoperative practice in other surgical specialties.

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Section 1: Overview of the Evidence-Based Project

Introduction

Surgical site infections (SSIs) are the most common hospital acquired infections and can detrimentally impact morbidity and mortality, readmission rates, and individual and organizational finances (Broex, van Asselt, Bruggeman, & van Tiel, 2009; Greenblatt, Rajamanickam, & Mell, 2011; Ploeg, Lang, Lardenoye, & Breslau, 2007). Lissovoy et al. (2008) estimated that SSIs nationally account for $1.6 billion in additional healthcare costs related to extended lengths of stay, additional treatments, and readmissions. SSIs disproportionately affect vascular patients because they are often found to have contributing risk factors including diabetes, older age, poor perfusion, and limb ischemia, making them more vulnerable to developing SSIs (Cheadle, 2006; Ploeg et al., 2007).

Recent data received from the National Surgical Quality Improvement Project (NSQIP) 2016 semiannual report identified a spike in the rates of SSIs among vascular surgical patients at an urban, acute care hospital during the 2015 fiscal year (NSQIP, unpublished data). This increase in SSIs prompted an evaluation of SSI prevention practices at the project site to determine if appropriate strategies were in place to reduce the infection rates. During this evaluation, vascular surgeons reported that patients often were not showered before surgery and were received in the operating room with odorous groins (Anonymous, personal communication, October, 2016). A change in practice to implement a preoperative wash for patients undergoing vascular surgery was determined to have the potential to reduce risk of infection postoperatively, standardize care across

the organization, and have care be consistent with evidence-based practice. A team of experts, including the chief of surgery, chief of vascular surgery, nurse practitioner, and a quality patient specialist, decided that a plan needed to be developed to implement this new approach. The intent would be to promote behaviors that would improve rates of SSIs and enhance care quality of vascular patients, standardize care across the organization, and create a supportive environment to sustain the practice change (Hodges & Videto, 2011).

Chlorhexidine surgical skin preparation has been shown to significantly reduce SSIs (Edmiston et al., 2008; Edmiston, Seabrook, Johnson, Paulson, & Beausoleil, 2007; Graling & Vasaly, 2013). Numerous health organizations, including the Centers for Disease Control and Prevention (CDC,1999), the National Institute for Health and Care Excellence (NICE, 2008), and the Canadian Patient Safety Institute (CPSI, 2014), have developed practice guidelines that recommend the use of a chlorhexidine surgical skin preparation preoperatively to prevent SSIs.

Problem Statement

SSIs have been a significant problem in the postoperative care of vascular patients at the project site for a number of years, with a recent increase over the past 5 years (NSQIP, unpublished data). NSQIP data demonstrated a 7% increase in surgical site infections compared to similar facilities and a 10% increase compared to other surgical patients within the same organization (NSQIP, unpublished data). These results prompted an internal review of practices among various surgical specialties within the

site. A potential solution highlighted during this review was the use of a chlorhexidine wash preoperatively to reduce SSIs.

There are various methods proposed to prevent SSIs; however, a preoperative wash has been consistently used by other services within the project site, and SSIs in those patients are within national benchmark data parameters for good practice. It was decided that expansion of this preoperative wash to vascular surgery patients would be an appropriate strategy. A preoperative chlorhexidine wash is recommended as best practice by numerous health organizations to prevent SSIs, making it significant to nursing practice. It is also a cost effective strategy (CDC, 1999; CPSI, 2014; NICE, 2008).

Purpose Statement

The primary purpose of this DNP project was to examine the literature on the use of chlorhexidine for the prevention of SSIs and to develop a plan that integrated evidence-based practice guidelines into the routine care of vascular patients undergoing surgery. A gap in nursing practice existed in the preoperative care of vascular patients, as the organization's vascular surgical service did not include a surgical skin preparation in their preoperative procedures. The gap in nursing practice that was the focus of this quality improvement project was the absence of a preoperative chlorhexidine surgical skin procedure for all vascular patients. This project addressed the gap in practice as I sought to improve the preoperative care of vascular patients by planning for the implementation of an evidenced based strategy to reduce SSIs. The development of a plan was guided by a review of the literature and clinical recommendations from (a) NICE (2008): *Surgical Site Infections: Prevention and Treatment Guidelines*, (b) the

CDC (1999): *Guideline for Prevention of Surgical Site Infection,* and (c) the CPSI *Safer Healthcare Now* guidelines (2014): *Prevent Surgical Site Infections.*

There were four necessary elements consisting of the plan, intervention, data collection, and evaluation included in the planning to reduce SSIs among vascular surgical patients in an urban, acute care hospital. In the plan, a needs assessment was conducted to learn more about the needs within the vascular program and what resources were available or needed. In addition, through a stakeholder analysis, I identified the key players affected by or who would affect the implementation of the procedure. The intervention piece included the development of the chlorhexidine wash procedure, patient education resources, nursing educational in-service, and audit feedback criteria for stakeholder evaluation. Data collection included surveys to assess nurses' understanding of the content presented in the in-service, the Flesch Read Ease tool (2016) to evaluate the patient education pamphlet for patient readability, and an expert panel consisting of the chief of surgery, chief of vascular surgery, director of cardiac and vascular program, and a quality patient specialist, who were asked to provide feedback using the Getting to Outcomes (GTO) evaluation tool (Chinman, Imm, & Wandersman, 2004). In the evaluation, data from the data collection tools were analyzed and summarized with recommendations made for changes based on the findings.

This project aligns with the evaluation of a current healthcare practice, the development and planning for quality improvement, and the review of evidence focused on a specific issue. The development and planning for quality improvement were demonstrated in the planning for the implementation of a preoperative chlorhexidine

surgical skin preparation to improve patient outcomes related to SSIs. Lastly, evidence specific to the guidelines and recommended practices for the prevention of SSIs were reviewed and used to guide the development of the plan to implement a preoperative chlorhexidine surgical skin preparation for vascular patients to address this gap in practice.

Project Objectives

The overall aim of the project was to develop a plan to implement a preoperative chlorhexidine wash. Specifically, the project objectives were to develop (a) a procedure for incorporating chlorhexidine into the preoperative care of vascular patients, (b) an educational program in-service for the nursing staff to increase awareness of the new procedure, (c) a patient education handout to increase patients' understanding of the wash procedure, and (d) a set audit and feedback criteria to measure the success rate of the project to improve patient outcomes related to SSIs. A panel of experts reviewed the overall planning approach of the chlorhexidine preoperative wash plan and advised on the feasibility and relevance of the approach to reduce SSI in this population.

Nature of the Doctoral Project

This DNP project was developed as a quality improvement project using Lewin's (1997) theory of planned change The methods included a literature review, national and international guideline review, rating of the existing research, current procedure review at the hospital site, procedure development at the hospital site aligned with national guidelines, nursing education module development, stakeholder meetings, description of patients' preoperative washing procedures, development of audit and feedback criteria for

comparison against internal and external benchmarks, and an evaluation of the overall plan by a panel of experts. These experts included the chief of surgery, chief of vascular surgery, director of cardiac and vascular program, and a quality patient specialist.

The outcome measurements that evaluated the effectiveness of the plan for the chlorhexidine surgical skin preparation include (a) a staff survey presented in Appendix A to assess the effectiveness of the nursing educational program in-service, (b) the Flesch Reading Ease Readability tool (2016) presented in Appendix B to assess readability of the patient education material along with the teach-back method to assess patients' understanding of the procedure once implemented, (c) audit and feedback criteria presented in Appendix C that were collected and reviewed by me in collaboration with various organizational members and presented to the project team at team meetings to determine the effectiveness of the procedure on the quality indicators, and (d) the GTO evaluation tool presented in Appendix D that was used by the expert panel to determine the feasibility and relevance of the project approach.

Significance and Relevance to Practice

The significance of this project is its ability to decrease SSIs among vascular patients from its previous rate of 4.9% (NSQIP, unpublished data) within 1 month of implementation. Further, the project demonstrated clinical significance as I have uncovered an area in nursing practice that was suboptimal according to the most up-to-date evidence, and I identified a strategy that could improve patient outcomes and quality patient care. Much of the literature supports the use of a preoperative chlorhexidine wash, and multiple national organizations recommend its use for preventing SSIs. Many

stakeholders were impacted by this project, including patients and nurses, as they were required to carry out the new procedure. Executive decision makers needed to provide support to have the change implemented successfully. They initially saw a cost associated with the chlorhexidine use, which quickly outweighed the cost savings from the reduced rates of SSIs. This project also played a key role in the policy arena by informing stakeholders and policy makers about the benefits of implementing a chlorhexidine wash preoperatively. Policy that integrates a chlorhexidine wash in all preoperative vascular patients ensures nursing practice is evidence based and is integral to quality patient care.

Definitions of Terms

Listed below are the relevant terms used in this project.

Chlorhexidine wash: A chlorhexidine solution instilled scrub brush that is used as a skin antisepsis to wash the area of body that will be exposed to incision (Maiwald & Chan, 2014).

Evidence-based: An intervention shown to be effective based on scientific findings with a theoretical background (Hodges & Videto, 2011).

Stakeholders: Any person who is most affected by the DNP project; these include surgeons, nurses, patients, the manager, and the director (see Hodges & Videto, 2011).

Surgical site infection (SSI): An infection that develops in the part of the body from which the surgery was performed to include skin surface, deep soft tissue, and organ space infections (CDC, 2015).

Vascular surgery: The diagnosis and management of disorders of the venous, lymphatic, and arterial system, excluding the intracranial and coronary arteries (Society of Vascular Surgery, 2016).

Assumptions

This DNP project was led by 4 assumptions. The first assumption was the belief that implementation of a chlorhexidine wash preoperatively would reduce rates of SSIs in vascular patients. The second assumption was the belief that an educational program for nursing would be effective in increasing the staff's awareness that a chlorhexidine wash procedure would decrease rates of SSIs, which could increase the compliance with the procedure. The third assumption was that there would be a high rate of successful implementation of the chlorhexidine procedure. Lastly, it was assumed that planning for the implementation of a chlorhexidine preoperative procedure would be a feasible and reasonable approach to reduce SSIs. These assumptions were necessary in the context of the project as it gave direction to monitor the outcomes associated with the planning of the practice change and maintained the focus of the project.

Scope and Delimitations

The planning for the chlorhexidine preoperative surgical skin procedure was limited to nurses caring for patients undergoing vascular surgery at the hospital site who did not present with any contraindications for the use of chlorhexidine, such as an allergy. The educational program was provided to all nurses working in the Same Day Surgery unit, inpatient unit, and preoperative assessment clinic. The preoperative chlorhexidine wash was completed either by the patient themselves if the surgery was booked as an

outpatient, or by the nursing care provider if the patient was an inpatient at the project site prior to surgery. The project site areas that implemented the chlorhexidine preoperative wash included the Same Day Surgery unit, inpatient unit, and preoperative assessment clinic.

Limitations

One expected limitation of the DNP project was in the available resources at the project site. The unit areas were expected to be short staffed, making it difficult to find time to provide educational in-services to the nurses to make them aware of the new procedure. Providing one-on-one education to nurses on the unit was identified as a strategy to overcome this challenge. Another expected limitation was in the amount of time the staff nurses would have to spend educating the patients on the appropriate use of the chlorhexidine skin preparation. Ensuring a comprehensive patient education pamphlet that was easy to understand was available for nurses to distribute to patients to assist with the patient education piece and was a strategy developed to mitigate this limitation. It was also expected that patients would not accurately report their washing behaviors, and nurses would not document the use of chlorhexidine in patients, which would make it difficult to audit the success rate of implementation of the procedure.

Another challenge was inherently presented within the characteristics of the patient population. Vascular patients often have a multitude of comorbid conditions that place them at higher risk for infection. These extraneous variables were difficult to control and determine the effectiveness of chlorhexidine in the higher risk populations, and as a result, the findings were expected to be generalized to other surgical patient

populations. Recognizing these confounding variables helped when interpreting the findings (Grove, Burns, & Gray, 2013).

Implications for Social Change

In this project, I considered the political, social, and financial environment in current healthcare practices. Through the exploration of literature on the current practices and strategies used in the prevention of SSIs and providing evidence-based recommendations for the planning of a procedure, I aimed to remain consistent with the quickly changing political, social, and financial environment. In this project, I sought to positively impact how healthcare providers care for vascular patients preoperatively who are at risk for SSIs. In addition, I hoped to impact nurses' awareness of best practice guidelines available to inform the practice of preventing SSIs and reduce the inequities that were present in the prevention of SSIs at the project site. Through the focus of these areas, I worked to ensure that SSI rates were reduced significantly in time with the appropriate planning of a chlorhexidine preoperative skin preparation procedure.

Summary

SSIs have detrimental patient outcomes and are very costly for healthcare (Broex et al., 2009; Greenblatt et al., 2011; Ploeg et al., 2007). A recognized increase in the number of SSIs at the hospital site fueled the development of a project to plan for the implementation of a chlorhexidine preoperative wash for all patients undergoing vascular surgery. The practice at the project site did not include a chlorhexidine preoperative wash, despite the evidence that supported its effectiveness in reducing SSIs (Edmiston et al., 2007; Edmiston et al., 2008; Graling & Vasaly, 2013). The overall objective of the

DNP project was to develop a plan to implement a preoperative chlorhexidine wash that was considered a feasible and relevant approach to reduce SSI by the expert panel. The project was developed as a quality improvement project that would take place at the project site, which is a large urban teaching hospital, and was limited to patients undergoing vascular surgery. It was assumed that the planning of the implementation of a chlorhexidine preoperative wash educational program would be effective in increasing nursing staff awareness of the importance of a chlorhexidine wash procedure, leading to high rates of compliance with the procedure, and that the overall procedure would present a feasible and reasonable approach to reducing SSIs among vascular patients.

A review of scholarly evidence revealed the search strategy used to delineate sources for the support of evidence-based practices, theoretical underpinnings, and framework that guided the implementation of the project. In addition, a literature review was conducted to justify the rationale for the selected strategy.

Section 2: Background and Context Introduction

SSIs significantly affect patient outcomes and continue to be on the agenda for quality improvement initiatives at the project site. The purpose of the project was to create an evidence-based plan to improve practices in the care of vascular patients by planning the implementation of a preoperative chlorhexidine wash as a strategy to reduce SSIs.

Lewin's (1997) theory of planned change served as the theoretical underpinning used to guide the DNP project. A discussion will follow regarding the relevance of this project to nursing practice, background and context of the problem, and both my role and the role of the project team.

Sources of Evidence

Multiple sources of evidence were used to address the practice-focused question. The practice-focused question was based on best practices recommended by the most up-to-date evidence. The primary sources of evidence included the NICE (2008) *Surgical Site Infections: Prevention and Treatment Guidelines*, the CDC (1999) *Guideline for Prevention of Surgical Site Infection*, and the CPSI *Safer Healthcare Now* (2014) guidelines aimed to *Prevent Surgical Site Infections.* These sources all recommend the use of chlorhexidine preoperatively for the prevention of surgical site infections. The NICE guidelines provided a rigorous evaluation of published literature through manual literature searches and electronic databases, reviewed meta-analysis, and were validated through external and peer review. The evidence presented in the NICE guidelines is current and used literature searches, stakeholder consultations, and committee

discussions. The CPSI *Safer Healthcare Now* guideline described issues of SSI in all operative phases and is a tool that provides evidence-based recommendations for the prevention of SSIs. It is a systematic review that includes relevant literature from 2005 to 2013. The CDC guidelines provided a summary of the practice recommendations set forth by the CDC in preventing SSIs. Although the CDC guidelines are quite outdated, they demonstrate how the recommendations have not changed for decades and continue to be best practice.

The evidence stated above directly related to the purpose of the DNP project and provided the background evidence to support a change in practice to include a preoperative chlorhexidine preparation. A gap in nursing practice was identified at the project site that was not parallel with recent guidelines. These guidelines were used to educate and support the integration of this evidence-based practice change to reduce SSIs in vascular patients and were the foundation for sustainability of the practice change, which addresses the practice-focused question.

Published Outcomes and Research

A literature search related to the use of chlorhexidine preparation for the prevention of SSIs was conducted. Initially, the Medline (OVID) database from the practicum site's library database website was used to search for existing literature published from 1999 to 2016. Additional searches were also conducted through the Walden library using the Medline with full text and Cumulative Index to Nursing and Allied Health Literature database for literature also published from 1999 to 2016.

A Boolean search strategy was used with various key terms that are described in more detail and presented in Appendix E. The combination of terms was initially used to begin the literature search, such as *surgical site infection OR surgical wound infection*, as well as *chlorhexidine preparation OR chlorhexidine wash*. The literature search that is described above brought forth over 8,000 abstracts regarding surgical site infection through the Walden Library database, and over 34,000 abstracts through the project site library's database. There were also over 7,000 articles with full text from the *chlorhexidine preparation* search and over 34,000 when searching the key phrase *vascular surgery*. These three key phrases were combined using the Boolean term AND to narrow the articles to nine, 93, and 52 from the three databases, which made it relevant to the project question.

The scope of this literature review dated back to 1999 and captured all studies that were published during this time frame. This wide timeline was chosen because the CDC published the last recommendations in 1999, and this would ensure it was included. The literature search was comprehensive and ensured that all literature relevant to the research question was included. The literature search targeted meta-analysis, randomized controlled trials, retrospective studies, clinical trials, and systematic reviews. Relevant practice guidelines and expert opinions were also included when available. A separate search was conducted on relevant national websites to obtain current practice guidelines. The search strategies above are inclusive and exhaustive of the literature surrounding the topic of chlorhexidine use preoperatively for the prevention of SSIs, as it dated back far

enough to see the trends in evidence over the last few decades and was inclusive of all sources that presented guidelines on its use.

Concepts, Models, and Theoretical Frameworks

Lewin's (1997) theory of planned change was used to inform the project. Lewin's theory facilitates change through understanding group dynamics and how roles, interaction, and socialization can contribute or be a barrier to a sustained change (McGarry, Cashin, & Fowler, 2012). Understanding the situation's status quo is necessary to improve understanding of the forces that influence and formed it. Deeper understandings of these forces create a potential for change (McGarry et al., 2012). The primary focus of Lewin's theory is to identify the three stages that a change agent must go through for change to become sustainable (as cited in Mitchell, 2013). Change becomes part of a system with the 3-stage approach. The three phases are unfreezing, moving, and refreezing (Mitchell, 2013).

The initial unfreezing phase is a difficult task that maintains that the status quo must be challenged and old behaviors discarded (McGarry et al., 2012). The need for change must be recognized and mobilized for others to see (Shirey, 2013). In the project, the unfreezing phase was represented in the gap analysis that revealed current practice was lacking a chlorhexidine wash preoperatively. Through the use of literature, the status quo of current practice was challenged based on the recommendations to incorporate a chlorhexidine wash in the preoperative care of vascular patients. Involving front line nursing staff in the planning of this program would assist in unfreezing the status quo and a group dynamic that is supportive of the change.

The moving phase involves the actions that transition thoughts and behaviors of individuals or groups toward a change (Shirey, 2013). In the moving phase, the creation of a detailed plan to incorporate chlorhexidine into the preoperative care of vascular patients and engaging front line nursing staff to try out the proposed change was necessary. Coaching new staff by providing educational in-services and patient education materials helped the staff overcome fears and provided clear communication about the project to avoid losing sight of the targeted change (Shirey, 2013).

The refreezing phase is the third and final stage in Lewin's (1997) theory. During this stage, the demands of the practice change stabilize and begin to embed in the existing systems policies and practices (Shirey, 2013). During this phase, a new equilibrium is created and recognized as the new status quo, which is crucial in making a change sustainable (Shirey, 2013). In this project, the audit criteria served as an ongoing mechanism for understanding sustainability of the change.

Reducing rates of SSIs for vascular patients has been on the project site's agenda for a number of years with efforts to reduce costs and increase efficiencies within the organization. Since the project site's recent involvement in NSQIP, SSIs were identified as an area for improvement in vascular patients compared to other surgical specialties (NSQIP, unpublished data). This prompted further assessment within the program and identified a difference in the preoperative care of patients for preventing SSIs compared to other specialties. The status quo in the care of vascular patients reflects a gap in nursing care, as vascular patients were not receiving a preoperative chlorhexidine wash. Efforts to challenge the practice of preoperative care, transition new evidence into

practice, and establishing a new standard of practice was well guided by Lewin's (1997) theory of planned change as a framework for planning this quality improvement project.

A synthesis of a number of resources informed the research question. A review of literature revealed that implementing a preoperative chlorhexidine wash could significantly reduce SSIs. Understanding the causes and risk factors for SSIs as well as patient educational needs and self-care habits are essential for preventing SSIs. Vascular patients often have multiple factors, such as comorbidities and self-care behaviors that place them at higher risk for developing infections. The self-care behaviors that contribute to SSIs are related to personal hygiene and the care of open wounds. Approaching these factors systematically using Orem's (1995) self care deficit theory is ideal to tackle the challenges associated with increased SSIs. Orem's theory of self-care deficit recognizes an individual's ability to meet the needs of self-care and also the need for nursing care (Orem, 1995). The self-care deficit for this project referred to the patient's need for education related to the prevention of SSIs through appropriate wound care and hygiene prior to surgery. Preoperative care of patients included assistance with the chlorhexidine wash if not done at home. Hartweg (1990) identified that self-care deficit occurs when patients are unable to meet their needs of self-care, and nursing must provide care on behalf of the patient. Nurses were educated on the procedure for implementing the chlorhexidine wash preoperatively, and patients were educated on the self-administration of the chlorhexidine at home. Orem's self-care deficit theory was used in the assessment of patients' ability to perform self-hygiene and inform nurses on who would require added teaching or hands on care.

Relevance to Nursing Practice

The project demonstrated relevance in nursing practice as I approached the clinical care of patients from a quality and patient safety perspective. SSIs have been closely linked to other hospital acquired infections, high morbidity and mortality, and return to surgery (Broex et al., 2009; Greenblatt et al, 2011; Ploeg et al., 2007).

In a comprehensive review of the literature, I found evidence from multiple sources that a preoperative skin preparation is effective in reducing SSIs without posing any risks to the patient. Despite recommendations from the literature, preoperative care of vascular patients was without a chlorhexidine preparation. Multiple organizations recommend a chlorhexidine preoperative surgical skin preparation in all patients undergoing surgery (CDC, 1999; CPSI Safer Healthcare Now, 2014; NICE, 2008). Nurses play a key role in the monitoring, management, and prevention of SSIs. It is essential for nurses to understand and be involved in evidence-based practice so that they can positively affect patient outcomes. The role of the advanced practice nurse is critical in the development of the procedure for the preoperative care of patients and applying appropriate guidelines to facilitate evidence-based practice.

At the project site, other surgical specialties such as cardiac and orthopedic surgery have built the use of a chlorhexidine wash preoperatively into the standard of care for their patients. This doctoral project could advance nursing practice as it demonstrates leadership in nursing through the planning of an evidence-based strategy and standardizing care across the project site. The project also provides guidance and

direction to other organizations similar to vascular who had not implemented the chlorhexidine as a standard of care.

Local Background and Context

Congruent with data from NSQIP, high rates of SSIs were identified in the vascular patients at the DNP project site within 30 days postoperative (NSQIP, unpublished data). Many patients present postoperatively with SSIs, with literature quoting an average 5% rate of SSIs developing after any surgical procedure (NICE, 2008). Data from the 2016 NSQIP annual review demonstrated higher rates at the project site, with numbers reaching up to 11% of all vascular cases (NSQIP, unpublished data). According to the literature, 60% of SSIs are preventable (Woods, 2005). These data, along with theoretical and empirical literature, were the driving factors for the decision on the DNP project design.

The plan to implement a chlorhexidine preoperative skin preparation was targeted to take place within a hospital organization that is a regional surgical center, which provides specialized care to vascular patients in both the preoperative outpatient and preoperative inpatient settings. Prior to any surgery, patients are assessed in the preoperative clinic by anesthesia to ensure they are medically fit for surgery. This is the setting in which the patients received the patient education handout with instructions to wash the night before and morning of their surgery. The morning of surgery, patients are either admitted to same day surgery or an inpatient unit. These were the settings where they received the chlorhexidine surgical skin preparation if not already done at home. The project is aligned with the project site's strategic plan to continuously refine delivery

of care with the goal to improve safety and quality patient care (Hamilton Health Sciences Corporation, 2016).

The use of chlorhexidine for reducing SSI has been under much debate over the years, with numerous studies demonstrating no significant reduction in SSIs following a preoperative chlorhexidine surgical skin preparation (Anderson et al., 2014; Dumville et al., 2015; Maiwald & Chan, 2012). However, many researchers have demonstrated a significant benefit in reducing the colonization of microbial bacterial on the skin's surface (Edmiston et al., 2007; Edmiston et al., 2008). In addition, Graling and Vasaly (2013) found a significant reduction in infection rates with the use of a chlorhexidine preoperative preparation. Despite these conflicting data, many national guidelines continue to recommend the use of a chlorhexidine scrub preoperatively to reduce risk of SSIs (CPSI *Safer Healthcare Now*, 2014; Mangram, Horan, Pearson, Silver, & Jarvis, 1999; NICE, 2008).

The project was applicable to provincial goals, as it can result in a cost savings for the project site. In Ontario, the location of the project, the funding allocation is now a patient-based funding, where the funding follows the patient (Ministry of Health and Long Term Care, 2015). The patient-based funding structure has two funding models: (a) the health based allocation model that is based on patient demographics and complexity of care and (b) quality based procedures that considers types and groups of patients using rates based on best practices and efficiencies. With this funding model in mind, performance measurement is a government concern (Ministry of Health and Long-Term Care, 2015). There is a strong drive for quality improvement within the project site, as the

Ministry of Health and Long-Term Care (MOHLTC) requires yearly submission of quality improvement plans as a means of expressing targets and quality goals. This made the DNP project applicable to the MOHLTC goals in improving quality patient.

Role of the DNP Student

Currently, I practice in the outpatient setting as a nurse practitioner, conducting follow-up visits on patients postoperatively. I led the planning for the implementation of the chlorhexidine preoperative skin preparation. This included developing the protocol for the procedure, developing an educational program for nurses, developing an education pamphlet for patients, developing criteria for audit and feedback purposes to evaluate the success rate of the project, and establishing an expert panel to review the entire plan for its feasibility and relevance.

I conducted a needs assessment of the organization, patients, and nursing staff to determine the resources needed to implement the change in practice and the resources needed to ensure sustainability. I conducted education sessions for the front-line staff and created education pamphlets for patients to receive preoperatively.

As a Nurse Practitioner who works in the outpatient clinic, the topic of SSIs has been a large part of managing the care of patients postoperatively. These infections influence my desire to reduce the incidence of SSIs and improve the outcomes of vascular patients. Reviewing the evidence was a large part of my role in the DNP project. Through the practicum portion, I was able to network with stakeholders and executive decision makers of the hospital site, to establish an expert understanding of the processes within the organization to ensure sustainability.

The factors that motivated the project are my dedication to the nursing profession and strong value for evidence-based practice. Choosing to plan for the implementation of a preoperative chlorhexidine preparation was largely affected by the literature, but also influenced by other surgical specialties who are already utilizing this as a standard of practice.

There was a potential for citation bias to occur when certain literature was more cited, which could be addressed through conducting a thorough literature review and remaining mindful of the potential for this bias to occur (Grove et al., 2013). In addition, there was also potential for outcome reporting bias to occur if results were not reported clearly and accurately (Grove et al., 2013). To address this bias, I created a systematic and consistent audit and feedback plan as a way to capture outcome data and also remain mindful of this bias.

Role of the Project Team

The role for a project team was applied in the planning and development of the plan. Including stakeholders and people affected by the change improved the needs assessment, acceptance of the change, and captured educational needs of both nurses and patients (Hodges & Videto, 2011). The project team was used to brainstorm ideas for developing the procedure, attend regular meetings to offer support and ideas towards the educational piece for the nurses and patients, and update and educate front line staff that would be affected by the change.

The project team members included two nursing representatives, the chief of vascular surgery, a quality specialist and patient safety specialist, an infection control

practitioner, an infectious disease specialist, a data support analyst, and a vascular nurse practitioner. The team met on a biweekly basis to discuss the ongoing planning of the project. During these meetings, the members presented the background evidence on SSIs and the best practice literature on using chlorhexidine preoperatively. The literature was provided to the team prior to the meeting via email so that members could be prepared to discuss their thoughts or concerns. Special guest speakers from other surgical specialties currently using the chlorhexidine preoperatively were invited to discuss their experiences using it, as well as a quality patient specialist was invited to discuss with the team quality improvement goals and processes used at the project site.

During each meeting, minutes were documented with action items and additional topics from which the members wanted to share. The project team ensured an open line of communication via email and shared drive for the storage of information specific to the work set forth by the project team. The project team was responsible to review the minutes from each meeting and ensured they were up to date with current activities placed as action items. Once the project planning was completed, a panel of experts consisting of the chief of surgery, chief of vascular surgery, director of cardiac and vascular program, and a quality and patient specialist reviewed the plan and provide feedback on its feasibility and relevance to reducing SSIs.

Summary

The use of chlorhexidine in the preoperative care of patients has been identified as a clear gap in the practice of vascular patients at the project site. A plan to implement a preoperative chlorhexidine preparation has been developed using both Lewin's (1997)

theory of planned change and Orem's (1995) self-care deficit theory. Through the planning, I used literature to demonstrated the relevance of SSIs to nursing practice, and the ongoing planning for my role and building of a project team.

A collection and analysis of evidence was completed to present the sources of evidence, project design, and methods of data collection and analysis that informed the planning for the implementation of the project.

Section 3: Collection and Analysis of Evidence

Introduction

At the project site, vascular patients have been found to have high rates of SSIs postoperatively (NSQIP, unpublished data). SSIs pose a significant burden on healthcare costs and affect patients' quality of hospital care. This problem has led to a plan to develop a quality improvement project for the implementation of a chlorhexidine preparation preoperatively in vascular patients to reduce SSIs. The plan was to implement the chlorhexidine skin preparation in the preoperative areas on vascular patients at the project site and was aligned with the hospital's strategic goal to improve quality patient care. This project was also aligned with the funding structure that requires ongoing quality improvement to meet the minimum standards set forth by the Ministry of Health and Long-Term Care (MOHLTC) (2015).

A review of the evidence demonstrated the relationship between SSIs and the use of a chlorhexidine preparation preoperatively and how implementation of this strategy would address the problem of high rates of SSIs. A discussion will follow to demonstrate the evaluation plan of the DNP project.

Practice-Focused Questions

The problem of high rates of SSIs at the project site has been highlighted as a primary concern in the vascular population. SSI rates have been higher in vascular patients postoperatively than other surgical specialties at the project site. This was identified by the NSQIP, from the organizational benchmarking data that were captured over the 2015 year. After a formal review of practices, it was noted that other surgical

specialties at the project site have been using a preoperative chlorhexidine preparation in their patients, which is different in the current practice of vascular patients. This identified the gap in practice that did not include a chlorhexidine preoperative preparation in the vascular surgical group and led to the development of the following practice-focused question: In vascular surgery patients within an urban acute care hospital in southwestern Ontario, how does the planning of a chlorhexidine preoperative surgical skin preparation protocol impact progress toward improved care of vascular patients as measured 3 months postimplementation?

Outcomes were measured formatively through stakeholder meetings, SSI best practice review, and chlorhexidine procedure review. Data were collected to demonstrate differences in SSI rates compared to other surgical specialties, as well as pre- and post-implementation of the chlorhexidine procedure to demonstrate improvement. The chlorhexidine procedure review addressed progress towards the development of the chlorhexidine procedure, educational program for nursing staff and patients, and criteria for audit and feedback on the success rate of the procedure.

Outcomes were obtained over 1 month through the evaluation of the patient education handout using the Flesch Reading Ease formula (2016), the nursing education in-service using surveys to assess nurses' understanding of the content presented at the in-service, and set criteria developed for audit and feedback to measure the success of the project pre and postimplementation. Other outcomes consisted of stakeholder satisfaction with DNP project leadership, finalized planning of the chlorhexidine

procedure proposal, and a panel of experts who reviewed the planning of the chlorhexidine proposal and advised on the feasibility and relevance of the approach.

Procedures and Methods

Many strategies were incorporated into the planning for the implementation of the chlorhexidine procedure and were completed at many levels within a corporation, from the frontline staff to levels of administration. Planning for implementation was considered a multidisciplinary approach that involved all stakeholders who would be affected by the change and used strategies that were cost effective. The procedures and methods of the program planning are presented in Appendix F identifying the content, teaching methods, timeframe, and the evaluation of the context for each objective.

Development of the Chlorhexidine Procedure

When developing the steps involved in the preoperative skin preparation, it was important to consider the type of solution to be used. Chlorhexidine has been found to provide preferential antisepsis over all other preoperative antiseptic agents (Noorani, Rabey, Walsh, & Davies, 2010). Using a 2% chlorhexidine solution has been found to be effective in reducing microbial skin bacteria without causing irritation at the site of use (Edmiston et al., 2008).

Nurses in the preoperative clinic followed the evidence-based protocol to instruct the patient to bath or shower the night before and morning of surgery using the chlorhexidine skin preparation over the site specified on the patient education pamphlet according to their surgical type. The site specifications are demonstrated in Appendix G. The nurses in the preoperative clinic were required to review and provide all patients with

the patient education pamphlet in Appendix F. In addition to the instructions, the nurses assessed for allergies.

Nurses in Same Day Surgery assessed patients' self-care behaviors and hygiene and documented if the patient completed the chlorhexidine skin preparation at home the night before and morning prior to coming to hospital. The Same Day Surgery nurses followed the evidence-based protocol to complete a preoperative wash using the chlorhexidine preparation according to the surgical type on the education handout prior to sending the patient to the operative theatre and documented this in the Meditech electronic documentation system.

Nurses in the inpatient unit assessed patients' ability for self-care and followed the evidence-based protocol to either instruct the patient to complete the chlorhexidine preparation the night before and morning of surgery or provided the wash for those patients who needed assistance with the wash. The inpatient nurses also documented this in the Meditech electronic documentation system.

Development of Education Program In-Service for Nurses

The education program for nurses was essential to ensure nurses were aware of the chlorhexidine protocol and understood what was needed to properly educate patients on self-administration. Staff were invited to attend an in-service by posting announcement posters to briefly describe "What's new in Vascular" around each unit. See Appendix H for an example of the poster announcement and Appendix F for the educational piece of the program plan. The in-services were scheduled in coordination with the unit educator to ensure the time reflected the best time for staff to be taken off

the unit for education and included multiple days and times to accommodate all nurses working various shifts in each of the units. The in-service was offered at four intervals of 20 minutes each in the morning and again in the afternoon to ensure patient care was not affected throughout the day, while capturing all staff working on the day of the in-service. The educator on the unit ensured the projector was available for use, and a room was booked for the duration of the in-services scheduled.

The education program for nurses consisted of an overview of the changes that would be made to the preoperative order sets, additions to Meditech online charting for documenting the chlorhexidine, and an overview of the patient education pamphlet that would be handed to patients. The preoperative patient education sheet can be found in Appendix F.

Development of the Patient Education Handout

The patient education handout provided a guide for nurses to use when educating patients on the proper use of the chlorhexidine wash preoperatively. The education handout also ensured patients were aware of the body location and timing to complete the wash. See Appendix G for an example of the patient education handout. Patients received the patient education in the preoperative clinic scheduled 1 week prior to their surgical date. Nursing staff provided one-on-one teaching for all vascular patients and were instructed to circle the picture corresponding to the patient's scheduled surgical procedure. The following instructions were provided: (a) Chlorhexidine is inactivated by soaps, and therefore the patient must ensure all soap and shampoo is rinsed off prior to washing with the chlorhexidine, (b) chlorhexidine can cause eye irritation and should not

be used near or around the eyes, and (c) the patient should not use a body lotion after using the chlorhexidine, as this would deactivate the bacteriostatic effects of the chlorhexidine.

The patient education handout was used in Same Day Surgery and was given to all vascular patients who did not complete the chlorhexidine wash prior to coming to hospital. Literacy levels of patients were assessed by the nurses using the teach back method, asking the patient to repeat the instructions back to confirm their understanding of the patient education provided. The patient education material was developed to reflect a fifth grade reading level using the Flesch Reading Ease Readability Formula (2016) presented in Appendix B.

Barriers to Implementation

There were a number of barriers that needed to be considered when planning for the implementation of a chlorhexidine preoperative preparation. The staff's readiness to change was a potential barrier when planning, as staff could have been reluctant to attend the educational in-services and could push back against the increased workload to educate and provide the chlorhexidine wash to patients. Inadequate resources could have also presented a barrier for planning educational in-services. These resources included insufficient human resources available on the unit that could have allowed for staff to attend the in-service as scheduled, limited rooms available to conduct the in-services, availability of the equipment for use during the in-service, and time as a resource that could have been limited and could have caused the education session to be shortened or rushed.

Archival and Operational Data

The project was developed as a quality improvement project using quality indicators as audit criteria and feedback review of the indicator results. The quality improvement plan that was developed is presented in Appendix I. The quality indicators were reviewed using the project site's operational data that were collected routinely for purposes other than the DNP project. The organization routinely collected data on vascular volume and activity and quality patient outcomes specific to reintervention rates, readmissions within 30 days, and SSI rates. These raw unadjusted data were reviewed quarterly by the organization to set benchmarking goals each fiscal year. The contributors to these data included five hospitals that specialize in vascular services within the local health integration network of Ontario. Other contributors to the data included vascular surgeons, managers, directors, infection control team, surgical resource nurses, quality specialists, an information controller of planning and analysis, and data support analysts of both the vascular program and infection control program.

These data were relevant to the practice problem, as they provided a baseline understanding of the project site's vascular activity and quality outcomes compared to other surgical specialties and were useful in determining if a change had occurred postimplementation of the preoperative chlorhexidine preparation.

These data were collected by the organization's information controller, who pulled the data from Integrated Decision Support Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) (M. Pyne, personal Communication, December 12, 2016). These data were raw unadjusted data, which

limited the validity of the findings. When an indicator was flagged, a chart review was conducted by the information controller using legal documents within the patient's chart to ensure the information was accurate (M. Pyne, personal communication, December 12, 2016). This represented the most reputable information, as there was no room for error of entry data.

The procedure to gain access to the unidentified operational data required approval from the director of the cardiac and vascular program as well as an application for data extraction sent to either the information controller, data support analyst, or decision support. A report was generated with unidentified aggregate data according to the data query. There was no access to personal health information.

Lastly, the NSQIP data source was based on medical record review using adverse event definitions completed by the quality specialist and safety patient specialist, who are the review team assigned to enter data into NSQIP. The methods for outcome analysis for vascular surgery have been extensively validated with numerous refinements over the years. Data were received from the semiannual NSQIP report and presented in aggregate format without any patient Identifiers

Evidence Generated for the Doctoral Project

Population and Sampling

All patients scheduled to undergo a vascular procedure at the project site received the preoperative chlorhexidine preparation, unless a contraindication to chlorhexidine was present, such as an allergy. The decision to include all vascular patients undergoing surgery was based on the project's goal to plan for quality improvement, rather than a

study design such as randomization. Quality improvement is an approach is used to examine and improve every process within an organization and with the evidence available, there should not be any population underserved (McEwen & Wills, 2014). It was essential that all vascular patients received the chlorhexidine wash preoperatively to ensure best practice was consistent across the practicum organization. The total number of vascular cases a year estimated to range from 720 to 750 operative cases that required the chlorhexidine wash and included the following types of vascular surgeries: carotid endarterectomy, open aortoiliac disease, open lower extremity revascularizations, and all endovascular procedures (NSQIP, unpublished data).

Recruiting Strategies

Recruitment of patients was not required, as all patients received the chlorhexidine wash preoperatively. All nurses working in the preoperative areas were expected to attend one of the mandatory education in-services.

Ethical Considerations

To ensure the ethical protection of patients, the project was designed as a minimal risk quality improvement project. The project was assessed by Walden University's International Review Board and the Research Ethics Board at the project site to ensure that the rights and welfare of all patients were protected. The Institutional Review Board approval number is 05-22-17-0541637. All subjects were assessed for an allergy to the chlorhexidine product, and if no contraindication presented, they received the evidence-based chlorhexidine preparation preoperatively to ensure that no person was neglected a treatment with potential benefit. The DNP project provided rational and deliberate

evaluation of evidence for the practice change. The decision to plan for the implementation of a preoperative chlorhexidine preparation was weighed against the desired values of the patients.

Data were gathered by the information controller, quality specialists, and patient safety specialist and were reported and presented in aggregate format without the use of any patient identifiers to protect patient identities. Data were stored in a password protected server that was housed within the project site's intranet accessible only by me. No information was stored on a computer or on manual paper copies.

Data Analysis and Synthesis

Data were collected using the techniques stated above and stored in an excel spreadsheet on a password protected server housed within the project site's intranet. Aggregated data on SSIs were collected by the quality specialist and patient safety specialists from other surgical specialties already using the chlorhexidine preparation preoperatively to be compared to vascular surgery outcomes using the NSQIP database and presented in aggregate format without the use of patient identifiers. Other outcomes were extracted by the information controller using the CIHI DAD database and presented in aggregate format, with values entered into an excel spreadsheet for comparison.

Project Evaluation Plan

The project evaluation plan was developed in consideration of the project objectives. The first project objective was to develop a procedure for incorporating chlorhexidine into the preoperative care of vascular patients. The planning of this procedure was evaluated by the expert panel using the Getting to Outcomes (GTO)

approach to program evaluation presented in Appendix D, to evaluate the overall planning approach of the chlorhexidine preoperative wash plan and advised on the feasibility and relevance of the approach to reduce SSIs (National Collaborating Centre for Methods and Tools, 2011). The National Collaborating Centre for Methods and Tools (NCCMT) developed the GTO tool to improve program quality and to address a gap between research and practice. The GTO focuses on program results and what could be learned from the impact and effectiveness of a program, rather than the output information (NCCMT). It uses a series of 10 questions, six of which are planning questions, two are evaluation questions, and two use data that sustain and improve programs.

Set audit and feedback criteria were used to determine the effectiveness of the chlorhexidine procedure in relation to the quality indicators presented in Appendix I. The second project objective to develop an educational program in-service for the nursing staff, was evaluated using a staff survey presented in Appendix A. Lastly, the third project objective to develop a patient education handout was evaluated using the Flesch Reading Ease Readability Formula (2016) presented in Appendix B.

Summary

The approach to planning for the implementation of a preoperative chlorhexidine wash included the development of the chlorhexidine procedure that included an ongoing plan for assessment that would make the plan sustainable, an educational in-service for nursing staff, and a patient education handout in terms of the methods and procedures. The entire plan was evaluated by a panel of experts prior to implementation.

Section 4: Findings and Recommendations

Introduction

SSIs are a growing concern in the vascular population at the project site, negatively impacting the quality of patient care and the costs of healthcare associated with these infections (Greenblatt et al., 2011; Ploeg et al., 2007). A gap in practice was identified at the project site, as the vascular service did not include a preoperative skin preparation in their preoperative procedures. This led to the practice-focused question that aimed to explore the planning of incorporating a preoperative chlorhexidine surgical skin preparation protocol and how it would impact the care of vascular patients postimplementation.

The purpose of the doctoral project was to address the gap in practice by incorporating a chlorhexidine preoperative surgical skin preparation for all patients undergoing vascular surgery and supporting this practice change with current evidence-based practice guidelines that recommend its use in the routine preoperative care of patients. This practice change was supported by multiple evidence-based practice guidelines: (a) NICE (2008): *Surgical Site Infections: Prevention and Treatment Guidelines*, (b) the CDC (1999): *Guideline for Prevention of Surgical Site Infection*, and (c) the CPSI *Safer Healthcare Now* guidelines (2014): *Prevent Surgical Site Infections.* Each of these practice guidelines recommended the use of a chlorhexidine wash preoperatively for the prevention of SSIs. Evidence in the NICE guidelines is current and was obtained through a rigorous evaluation of published research studies and meta-analysis that has been validated through a peer and external review process. As a

systematic review, the CPSI *Safer Healthcare Now* guideline includes current literature to provide evidence-based recommendations as a tool toward the prevention of SSIs. Though outdated, the CDC guidelines provide an important summary of practice recommendations and continue to be considered best-practice.

Findings

The data from the doctoral project were collected according to the project objectives and include (a) results from the staff survey evaluating the effectiveness of the program in-service that was provided to staff and are presented in Appendices J, (b) the results from the Reading Ease Formula to evaluate the readability of the patient education handout, presented in Appendix K, (c) the results from the GTO questionnaire that was completed by the expert panel to evaluate the overall quality of the doctoral project presented in Appendix L, and lastly (d) the Audit and Feedback outcomes are presented as figures within the body of the paper, demonstrating the effectiveness of the chlorhexidine preoperative wash at 1 month postimplementation.

Analysis of data gathered from the staff surveys revealed many themes and key words. Many of the responses were similar within each staffing group and differed slightly among staff from other units. For example, the staff survey revealed responses from the inpatient staff identifying the purpose of the changes to prevent infection rates. However, the major difference in responses was identified when staff were asked about who would administer the chlorhexidine wash. The staff survey revealed that 21% of the inpatient staff responded that patients would be administering the wash on the unit, 11% responded that the wash would be administered by the staff in the Day Surgery Unit, and

68% responded that the wash would be administered by the staff on the inpatient unit. See Figure 1.

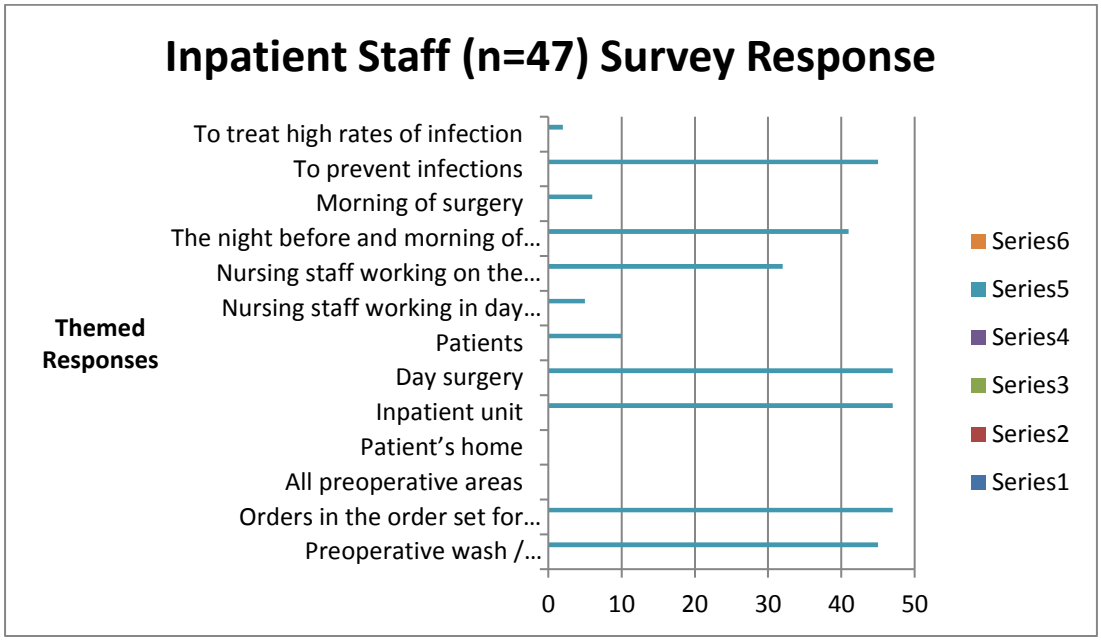

Figure 1. Inpatient staff survey response.

Conversely, 100% of the Day Surgery staff and 81% of the preoperative clinic staff identified that washes would be administered by the patient themselves. See Figure 2 and Figure 3.

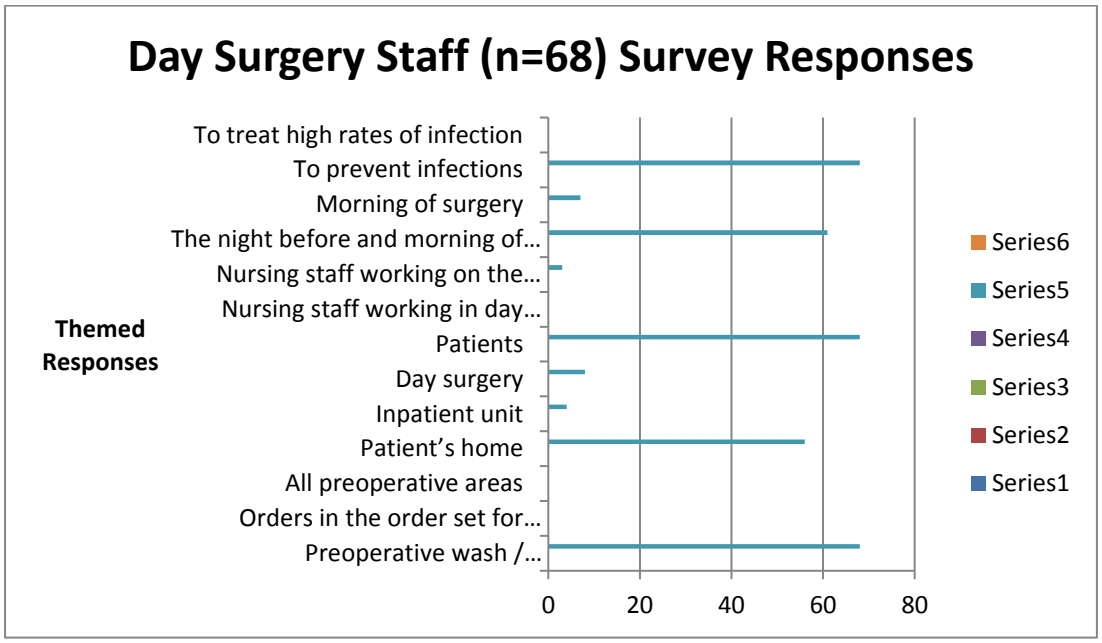

Figure 2. Day Surgery Staff survey response.

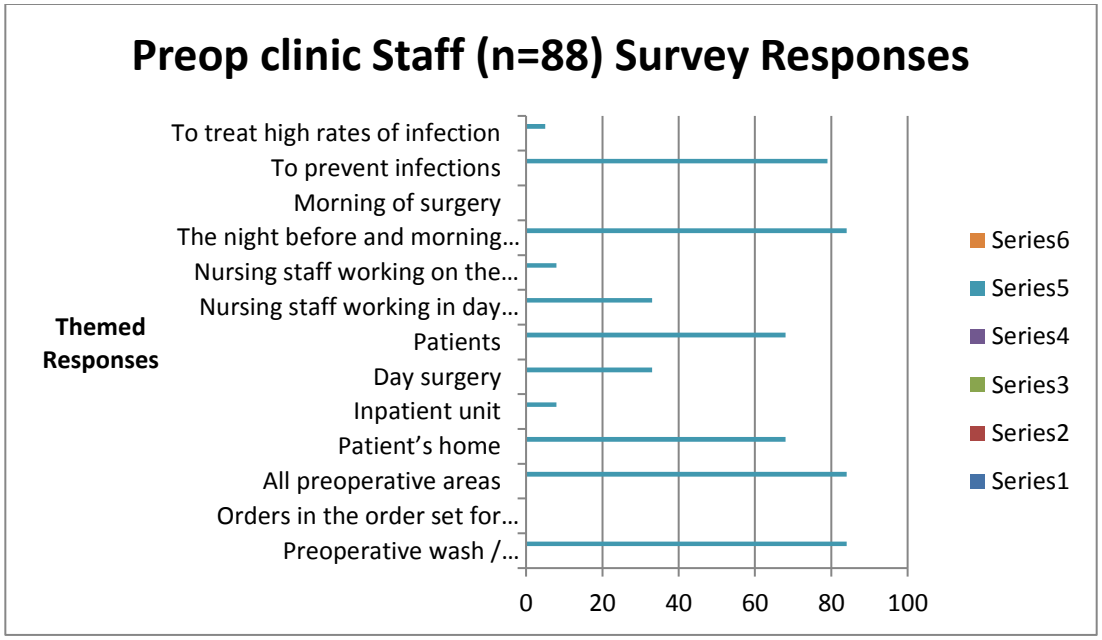

Figure 3. Preop clinic Staff survey response.

Another major difference in the responses generated from the staff survey demonstrated that 100% of the inpatient staff identified the location of the preoperative

wash to occur on the inpatient unit and Day Surgery Unit (N=47). Compared to the preoperative clinic staff, where 81% identified the location to be in the patients' home,1% identified the wash to occur on the inpatient unit, and 39% identified the wash to also occur on the Day Surgery unit (N=84). The Day Surgery Unit staff responses reflected that 82% responded that the wash was to occur in the patients' home,6% on the inpatient unit, and 12% on the Day Surgery Unit (N=68). As staff were able to respond to the questions with multiple answers, some questions may not equal 100%.

Results were tabulated and grouped according to similar responses, and the number of staff was accounted for in the synthesis of the results. A summary representing the most common and similar answers to each question is presented in Appendix J. The results were further broken down by area of practice to reflect the most common results according to the staffing unit. It is important to note that the answers from this survey demonstrate that the majority of the nursing staff, despite their unit of work, had a good understanding of the content that was presented in the in-service provided.

The Flesch Reading Ease Formula (2016) was used to analyze the readability of the content within the patient education pamphlet, which is presented in Appendix K. The Flesch Reading Ease Formula calculation accounted for 82 words, nine sentences, and 103 syllables within the patient education handout. Using the formula to analyze the content generated a score of 96.2, which falls between 90 and 100, representing a readability level to be consistent with the level of a fifth grader (Readability Formulas,

2016). This confirms that the patient education pamphlet should be very easily understood by the majority of patients (Readability Formulas, 2016).

The GTO questionnaire tool was completed by an expert panel during their evaluation of the plan to incorporate a chlorhexidine preoperative wash for vascular patients (Chinman et al., 2004). Results from the GTO questionnaire are presented in Appendix L. The expert panel clearly identified the goals, target population, and evidence used to reach the goals. They also identified that there will be ongoing review and feedback of outcomes presented to the executive members lending to the sustainability of the project. These data provide feedback on the feasibility and relevance of the doctoral project and demonstrate the expert panel's understanding of the overall planning and evaluation approach as well as the sustainability plan to reduce SSIs within the vascular surgical population. This supports the feasibility of the doctoral project and demonstrates relevance to address the gap in practice, with a plan for ongoing review to make it sustainable (Chinman et al., 2004).

Evaluation of the effectiveness of the chlorhexidine preoperative wash, audit, and feedback outcomes were collected and analyzed. The rates of SSIs prior to the implementation of the chlorhexidine preoperative wash were compared to neurosurgery and orthopedic surgery. Vascular surgery SSI rates were found to be 4.9%, compared to 2.9% in neurosurgery and 1.4% in orthopedic surgery. See Figure 4.

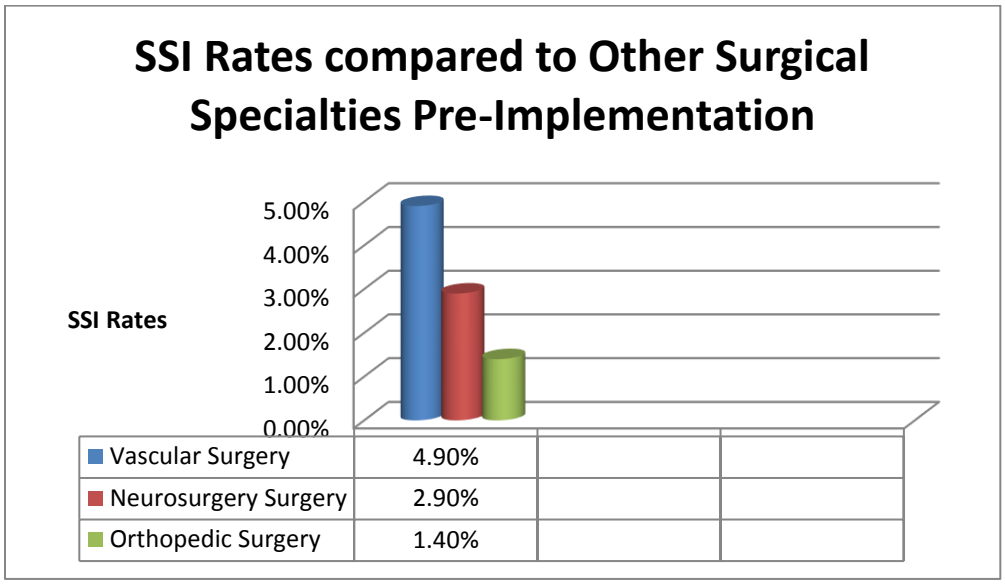

Figure 4. SSI rates compared to other surgical specialties preimplementation.

These data demonstrated that a problem did exist in the care of vascular patients, as the rates of SSIs among vascular patients were almost double that of neurosurgery and triple that of the orthopedic surgical specialty. These data represented the need and relevance to internally review the practices used in the vascular surgical services, thereby revealing the lack of preoperative skin preparation among these patients as the gap-in-practice largely contributing to this clinical practice problem.

Raw data was captured 1 month postimplementation of the preoperative chlorhexidine wash. On average there are 110 vascular procedures that occur on a monthly bases. These vascular surgery SSI rates preimplementation were 4.9% and dropped to 2.8% 1-month postimplementation, which demonstrate an almost 50% reduction in SSIs, further supporting the effectiveness of the chlorhexidine preoperative wash. See Figure 5.

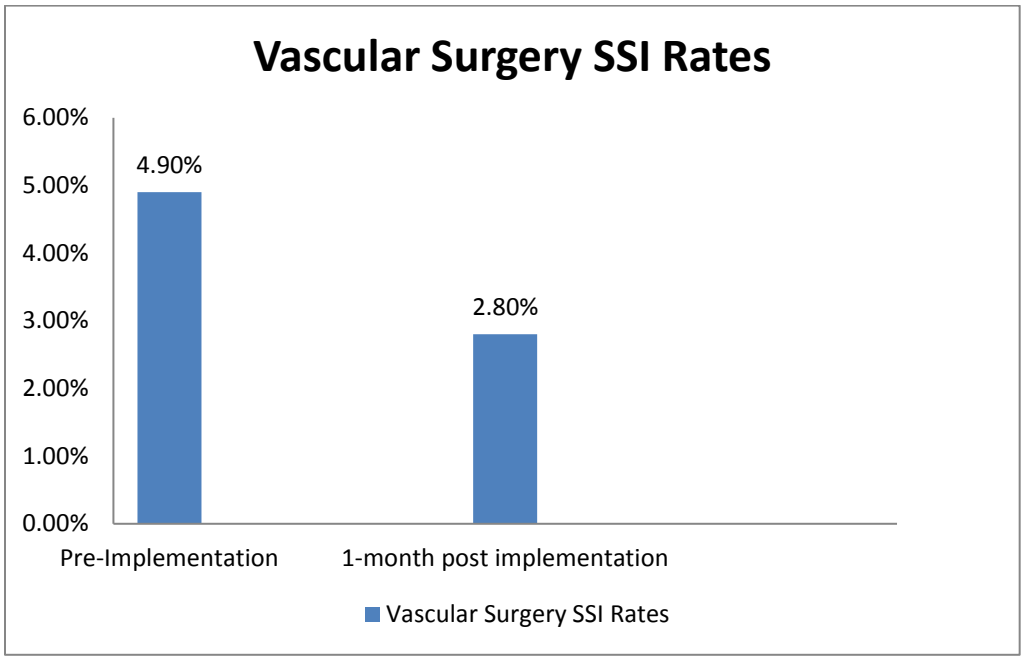

Figure 5. Vascular surgery SSI rates.

It is important to consider that the postimplementation data are raw data and merely present a rough estimation of the reduction in SSIs among vascular patients at the project site. Figure 6 and Figure 7 reflect a reduction in SSI related readmissions from 3.2% preimplementation to 2.6% postimplementation and a drop in reintervention rates from 1% to 0% respectively; however, these findings are reflective of a small sample in a limited time frame of 1 month and are not statistically significant.

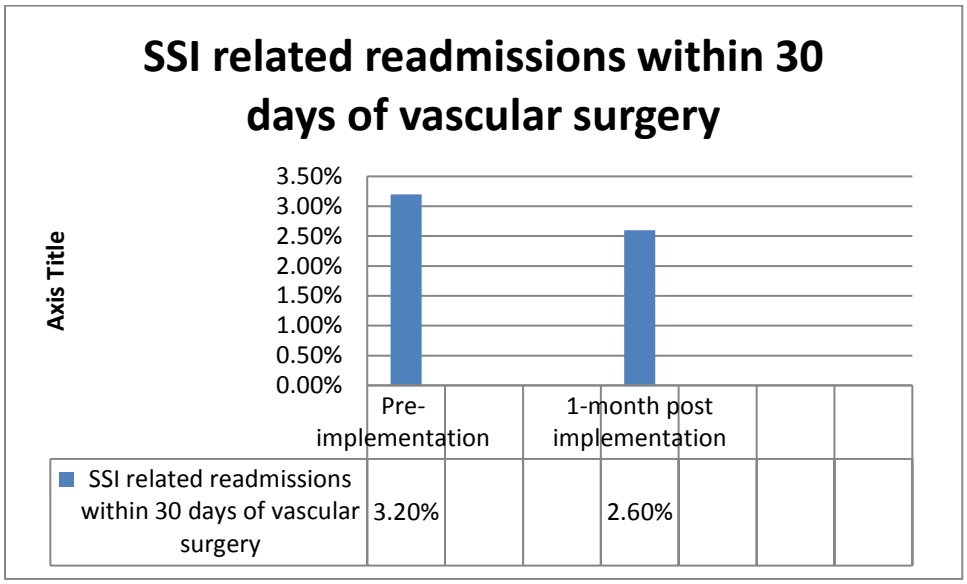

Figure 6. SSI related readmissions within 30 days of vascular surgery.

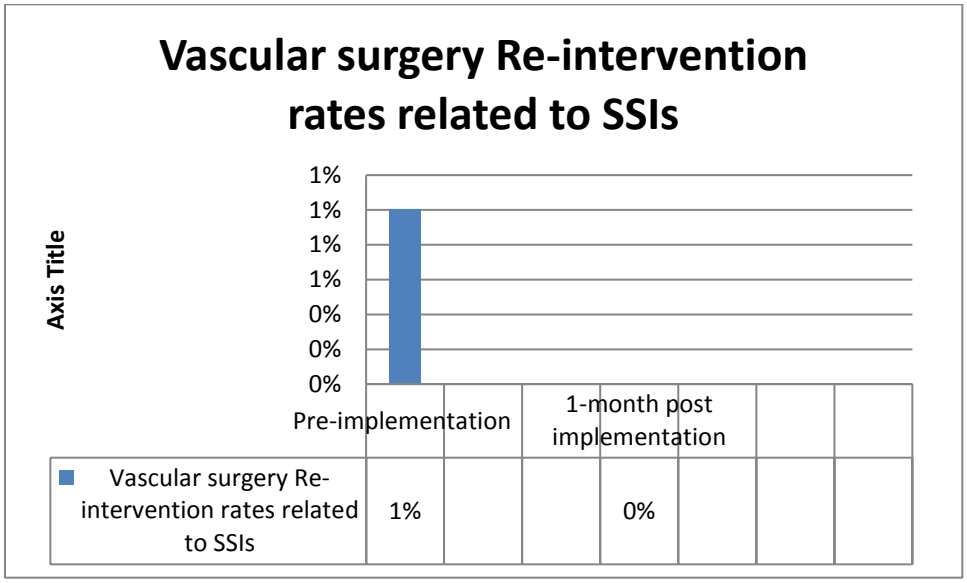

Figure 7. Vascular surgery reintervention rates related to SSIs.

One unanticipated limitation was that data were only available for the neurosurgery and orthopedic surgical specialties identified. Other surgical specialties did not have preimplementation data to provide for comparison, which would have provided a more representative comparison of the rates of SSIs among other surgical specialties

with similar risk factors for infection. Assessing staff compliance with the chlorhexidine preoperative wash was another unanticipated limitation. Because compliance was difficult to assess, it was impossible to demonstrate the findings were a direct result of compliance with the preoperative wash.

To facilitate change by understanding group interactions and the current forces that influence change within a unit, Lewin's theory of planned change was used to guide the doctoral project (Lewin, 1997). The three stages of Lewin's (1997) model assisted in the successful implementation of the project, as it provided a framework for identifying the gap in practice largely contributing to the identified practice problem, searching the current literature to identify an evidence-based practice change to bridge that gap, guiding the preparation of the nursing staff by providing in-services to educate and engage them in the practice change, and establishing a new equilibrium with the new practice change to ensure its sustainability.

Implications

Project findings support the ongoing use of a preoperative surgical skin preparation, as reduction in the incidence of SSIs within 1 month of implementation was demonstrated. This will empower nursing staff to continue evaluating practice trends to ensure the provision of high-quality evidence-based care to all patients and to engage in quality improvement initiatives to improve patient care.

The doctoral project findings will also influence future quality improvement projects, as it demonstrates an area where care was suboptimal and highlighted an area for improvement that was guided by evidence and best practices. This will guide quality

improvement initiatives to include best practices within other programs and create an interest to review their current practice of using a surgical skin preparation into their routine preoperative care. The findings may also power the nursing staff to get more involved with research in nursing and inspire them to conduct their own nursing research.

Implementing evidence-based best practices promotes social change by improving patient outcomes, reducing the burden of patient suffering, and reducing the overall cost of healthcare (Melnyk, Gallagher-Ford, Long, & Fineout-Overholt, 2014). Evaluations of the doctoral project suggested a decreased incidence of SSI among a patient population high risk for infection by implementing practice change based on the best available evidence, which may empower other organizational leaders to replicate the project, thereby improving patient outcomes across the organization.

Recommendations

After only 1 month of project implementation, evaluation of the efficacy of incorporating a preoperative chlorhexidine wash suggests a significant reduction in SSIs. The practice change was well supported by the current literature and demonstrated improvement in reducing SSIs among the vascular surgical population when implemented at the project site; therefore, evaluation of project implementation supports the efficacy of incorporating preoperative chlorhexidine skin preparation prior to surgical procedures to prevent postoperative SSIs, as widely discussed in the current literature. Preimplementation incidence of SSIs, however, should be accurately captured to facilitate adequate evaluation of implementation.

Use of the patient education handout in Appendix G was helpful to nursing staff when providing patient education regarding proper completion of the preoperative wash. Preimplementation nursing education was instrumental in gaining buy-in required of those charged with implementing the practice change, thereby facilitating compliance and creating an optimal environment for success and sustainability. For this reason, a comprehensive, preimplementation staff education program is highly recommended and should include all changes, dates of those changes, documentation expectations, and expectations for patient education. Concerns regarding changes to workload should also be addressed to facilitate maximum compliance with implementation. A copy of the in-service flyer used in this project is provided in Appendix H. Assignment of a unit champion who is available to provide accurate answers to staff questions is helpful in facilitating the practice change at the unit level and is highly recommended.

It is also recommended that the unit leaders remind staff of the practice change on the day of implementation to facilitate accurate evaluation. Project managers should provide ongoing feedback to the project team, unit managers, and nursing staff regarding compliance with the practice change and the incidence of SSI to highlight effectiveness of the practice change.

Contribution of the Doctoral Project Team

The doctoral project team consisted of two nursing representatives, the chief of vascular surgery, a quality specialist and patient safety specialist, an infection control practitioner, an infectious disease specialist, a data support analyst, and a vascular nurse practitioner. Working as a team facilitated effective and efficient project planning and

development to facilitate timely, cost-effective, evidence-based practice change. The team approach facilitated a rich understanding of the processes within the organization, yet provided distinction between the various roles that influence change. Members of the project team assisted with connecting stakeholders and brainstorming ideas to ensure the success of the program.

Nursing representatives were the voice for the nursing staff to ensure the change in practice would be realistic and not over burden them with tasks. There was a voice on the executive committee to assist in translating the need for the practice change: The chief of vascular surgery was also a source of support when implementing the practice change on that unit. The quality specialist, patient safety specialist, infection control practitioner, infectious disease specialist, and data support analyst gathered data related to SSIs from the various databases presented that information to the project team and provided ongoing feedback and support during the pilot project. As the doctoral student and project team leader, I conducted a literature review on the best practices for using chlorhexidine preoperatively for the prevention of SSIs, presented the evidence to the project team, completed the final planning for the project, implemented all aspects of the project, served as a unit champion, and collected and analyzed the data in preparation for presentation and dissemination.

The project team worked together to generate the final recommendations reflected in this paper. Also, team members made a collaborative decision to continue with the pilot project for an additional 2 months to facilitate analysis of 3 full months of data. Results of the evaluation after 3 full months of implementation will be provided at the

quality improvement rounds in the fall and extend the implementation of the chlorhexidine preoperative skin preparation to other surgical specialties within the project site as well as to other hospital sites with the local health integration network that service the vascular population.

Strengths and Limitations of the Project

The doctoral project created an excellent foundation for the implementation of the chlorhexidine preoperative skin wash. Including the various project team members in the planning facilitated a comprehensive approach and was a strength of the project, as it ensured inclusion of a stakeholders from all areas. This also facilitated a greater understanding of the roles within the organization and generated buy in from executive members to help support the progression and implementation of the project. Stelson, Hille, Eseonu, and Doolen (2017) discussed factors that affect project success and determined that managerial support, communication, and affective commitment were among the most important during the implementation of change.

Another strength of the project was the timeline that was developed and followed, ensuring all aspects of the project was planned and understood prior to implementation and allowing time for concerns to surface with sufficient time to prepare for the barriers that impede acceptance and implementation. It also provided time for the staff and managers to recognize and appreciate the identified practice problem, reducing the overall resistance to change practice upon implementation.

One limitation of the doctoral project was the inability to accurately capture the staff's compliance with implementing the chlorhexidine. Capturing these data could have

provided a stronger correlation between the use of chlorhexidine and the reduction of SSIs. These data would also be useful when providing feedback to staff on their performance, encouraging them to continue with the current practice change. It would be recommended in the future planning of projects addressing comparable topics using similar methods to consider the details of capturing the compliance rate of the action implemented.

Section 5: Dissemination Plan

The dissemination of the findings generated from this doctoral project work within the organization will initially occur as a presentation during the quality improvement rounds in the fall. This will capture an audience who will include executive hospital members such as program directors, managers, educators, and practitioners throughout various specialties within the organization. Results of the doctoral project will also be disseminated in the form of a presentation at the Advance Practice Nurse meeting within the organization, followed by a poster enlarged and placed on display within the vascular unit as a daily reminder to the nursing staff for their continued dedication and hard work towards improving patient care. It will also serve as a reminder of the need for sustaining the change and create a culture that rewards the utilization of evidence-based best practices.

Evaluation of the doctoral project represents outcomes related to SSIs, with particular attention to preoperative procedures. Dissemination of this work would be appropriate for many audiences to capture the broader nursing profession and would be well suited to be presented at many healthcare events. Providing a poster presentations or verbal presentation at a professional conference such as those hosted by The Association of periOperative Registered Nurses, Operating Room Nurses Association of Canada, or Canadian Association of Medical Surgical Nurses would serve to capture nurses in many surgical specialties. It would also be important to disseminate the results at events hosted by the Canadian Society of Vascular Nursing as well as the Canadian Society of Vascular

Surgery to ensure vascular surgery groups across Canada are aware of the benefits of using chlorhexidine preoperatively for the prevention of SSIs.

Analysis of Self

During the planning and development of this doctoral project, I have noticed a clear transition in my involvement with quality initiatives in my professional role as a nurse practitioner, scholar, and project manager. These experiences shaped my understanding, improved my confidence, and stimulated my interest to improve quality patient care.

As a nurse practitioner, I have become more sensitive to recognition of clinical practice issues. My confidence in conducting rigorous literature reviews, incorporate evidence into practice, and advocating for practice change has grown tremendously. I have also developed leadership qualities and networking abilities that enable me to seek out stakeholders and support from executive members in the organization in which I practice.

As a scholar, I have noticed an improvement in my knowledge and motivation towards lifelong learning, writing and social skills, level of critical thinking and application, and responsibility to take on leadership activities independently. I have become more engaged in scholarly work and research in my organization and have created a foundation for continuous growth in planning and achieving goals. Further, I have strengthened my planning, research, and writing skills throughout my journey as a doctoral student. My confidence and leadership abilities have been evidenced by meeting my goals of the doctoral project. I work more efficiently, set realistic and timely goals,

and communicate well with my supervisor and other team members. Additionally, I have maintained an open line of communication with the university and worked diligently to stay on task to meet deadlines in accordance with the timeline set for the doctoral project.

In the upcoming year, I aim to improve my verbal presentation skills by presenting my project findings at conferences and to other nurses. I also aim to maintain and expand my memberships in professional organizations to facilitate more involvement in the translation of the best available evidence into practice by attending professional events and networking with members from other organizations. Finally, I plan to actively seek opportunities to gain more experience with and participate in quality improvement initiatives in the organization.

Summary

Multiple sources of evidence support the use of chlorhexidine as a skin preparation preoperatively to reduce the risk of SSIs. In this doctoral project, which was implemented as a pilot project in vascular surgery, I demonstrated the effectiveness of a preoperative chlorhexidine skin preparation in reducing the rates of SSIs among patients undergoing vascular surgery within one month of implementation. These outcomes provide a foundation for continuous project support, ongoing outcome evaluation, and continuous best practice review throughout the organization to ensure practice is evidence-based in other specialty areas to improve outcomes in patients.

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Appendix A: Staff Survey

1. What is new to the preoperative care of vascular patients?
2. Where will the chlorhexidine wash be implemented?
3. Who will administer the chlorhexidine wash?
4. When will the chlorhexidine wash be ordered to be applied?
5. Why is the chlorhexidine wash important for patient care?

Appendix B: The Flesch Reading Ease Readability Formula (2016)

This formula is primarily used to assess the reading difficulty of passages written in English. It is a standard formula used to assess readability and is used by many U.S agencies, including Microsoft Word.

The Specific Mathematical formula is:

$$RE = 206.835 – (1.015 \times ASL) – (84.6 \times ASW)$$

RE= Readability Ease (ranging from 0-100)

ASL= Average Sentence Length (Number of works divided by number of sentences)

ASW= Average syllables per word (number of syllables divided by the number of words)

Scores between 90-100 are considered easily understood by an average 5th grader

Scores between 60-70 are considered easily understood by an average 8th or 9th grader

Scores between 0-30 are considered easily understood by college students

90-100 : Very Easy

80-89 : Easy

70-79 : Fairly Easy

60-69 : Standard

50-59 : Fairly Difficult

30-49 : Difficult

0-29 : Very Confusing

When applying this formula to the patient education material, a score of 90 was generated. This confirms its readability to be consistent with that of a 5^{th} grader.

Appendix C: Audit and Feedback Criteria

Audit (quality indicators)	Feedback (how data will be reviewed)
Vascular SSI rates compared to other surgical specialties	The Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP, will collect data from the NSQIP database on other surgical specialties who have already been using the chlorhexidine preparation preoperatively to be compared to vascular surgery outcomes NSQIP data is presented in aggregate format without any patient identifiers
Compare Vascular SSI rates pre and post implementation of the chlorhexidine wash and quarterly thereafter	CIHI DAD database and values entered into an excel spreadsheet by the Information Controller for comparison. Raw data related to this query will also be collected by the Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate format in an excel spreadsheet without patient identifiers

SSI related readmissions within 30 days of surgery	National benchmark data will be collected and reviewed by the Information Controller to determine if there was a reduction in SSIs and readmissions within 30 days of surgery. The Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP, will also collect data from the NSQIP database related to this query and present in aggregate format without any patient identifiers
SSIs within 30 days of surgery	Raw data related to this query will be collected by the Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate format in an excel spreadsheet without patient identifiers
Re intervention rates related to SSIs	Raw data related to this query will be collected by the Information Controller, Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate

	format in an excel spreadsheet without patient identifiers.

Results will be presented by the project leader to the project team at team monthly and quarterly meetings, as well as the expert panel on a quarterly bases for review of the project

Appendix D: Getting to Outcomes (GTO) Program Evaluation Tool (Chinman, Imm, & Wandersman, 2004)

Planning Questions

1. Needs and Resources. What are the underlying needs and conditions in vascular?
2. Goals. What goals, target populations and objectives will address the needs and change the underlying conditions?
3. Best Practice. Which evidence-based models and best practice programs can you use to reach your goals?
4. Fit: What actions do you need to take so that the selected program "fits" the vascular context?
5. Capacities. What organizational capacities are needed to implement the program?
6. Plan. What is the plan for this program?

Evaluation Questions

7. Process. How will you assess the quality of program implementation?
8. Outcomes. How well did the program work?

Sustainability Questions

9. Continuous Quality Improvement. How will you incorporate continuous quality improvement strategies?
10. Sustainability. How will effective programs be sustained?

Appendix E: Boolean Search Strings

Medline (OVID) (1999-2016)

Search Number	Search History	Results
1	Surgical site infection OR surgical wound infection	34,723
2	Chlorhexidine preparation OR Chlorhexidine	7296
3	Vascular Surgery OR Vascular surgical procedures	34,757
4	2 AND 3	9
5	1 AND 3	531
6	1 AND 2 AND 3	7
7	Infection Prevention	3244
8	1 AND 2 AND 7	5
9	Stetler's Model	2
10	Quality Improvement	34,488
11	9 AND 10	0
12	Evidence-based practice	14,449
13	9 AND 12	0
14	Orem's theory	86

Medline with full text (1999-2016)

Search Number	Search History	Results
1	Surgical site infection OR surgical wound infection	8,271
2	Chlorhexidine Preparation OR Chlorhexidine wash	130
3	Vascular surgery	19,792
4	2 AND 3	93
5	1 AND 3	5,657
6	1 AND 2 AND 3	5
7	Infection Prevention	7,245
8	1 AND 2 AND 7	470
9	Stetler's model OR Stetler	410
10	Quality Improvement	30,069
11	9 AND 10	6
12	Evidence-based practice	14,495
13	9 AND 12	3
14	Orem's Theory	124

CINAHL (1999-2016)

Search Number	Search History	Results
1	Surgical site infection OR surgical wound infection	2,898
2	Chlorhexidine Preparation OR Chlorhexidine wash	73

3	Vascular surgery	3,224
4	2 AND 3	52
5	1 AND 3	3,373
6	1 AND 2 AND 3	0
7	Infection Prevention	31,244
8	1 AND 2 AND 7	17
9	Stetler's model OR Stetler	17
10	Quality Improvement	28,716
11	9 AND 10	3
12	Evidence-based practice	43,151
13	9 AND 12	11
14	Orem's Theory	111

Appendix F: Program Planning

Objective	Content	Teaching Methods	Time	Evaluation
1. Develop a procedure for incorporating chlorhexidine into the preoperative care of vascular patients	• When, by who, and how the procedure will take place • Why the procedure is important • Physician orders for the chlorhexidine wash • How to document the	• Patient education handout • Nursing educational in-services • Emails • Posters	• The overall planning for the procedure will take 4 months • Patient educational handouts will be developed 1 month prior to the go live of the project • The staff educational in-services will begin 1 month prior	• The GTO evaluation tool will evaluate the program quality • A panel of experts will review the overall planning approach of the chlorhexidine preoperative wash plan using the GTO tool

	chlorhexidine wash • Which surgical site locations will need to be washed based on the planned surgery		to the go live of the project and will continue until the project begins • Email reminders will be sent out 1 week before implementation • Posters will be placed on the unit 2 weeks before implementation	and advise on the feasibility and relevance of the approach to reduce SSI • Develop a set audit and feedback criteria to measure the success rate of the project

2. Develop an educational program in-service for the nursing staff to increase awareness of the new procedure	• New addition of the chlorhexidine wash in the pre operative care of vascular patients • Patient education pamphlet • The timing, location, and who will be implementing the wash • Why the chlorhexidi	• Through in-service session • 1:1 education • Power point presentation	• In-service will occur at four intervals of 20 minutes per day, 3 days per week for 3 weeks • 1:1 sessions will capture any staff who missed the in-service	• A survey will be used to assess the understanding of the content presented in the in-service

	ne wash is important to patient care • How to assess and document the chlorhexidine wash			
3. Develop a patient education handout to increase patients' understanding of the wash procedure	• Procedure on how and when to use the chlorhexidine wash • The body areas that need to be washed based on	• Nurses to go over the handout with patients during their pre-op appointment	• Will commence when the project goes live. • Every vascular patient who attends the pre-op clinic will receive education	• Education handout will be evaluated using the Flesch Reading Ease formula to determine ease of readability.

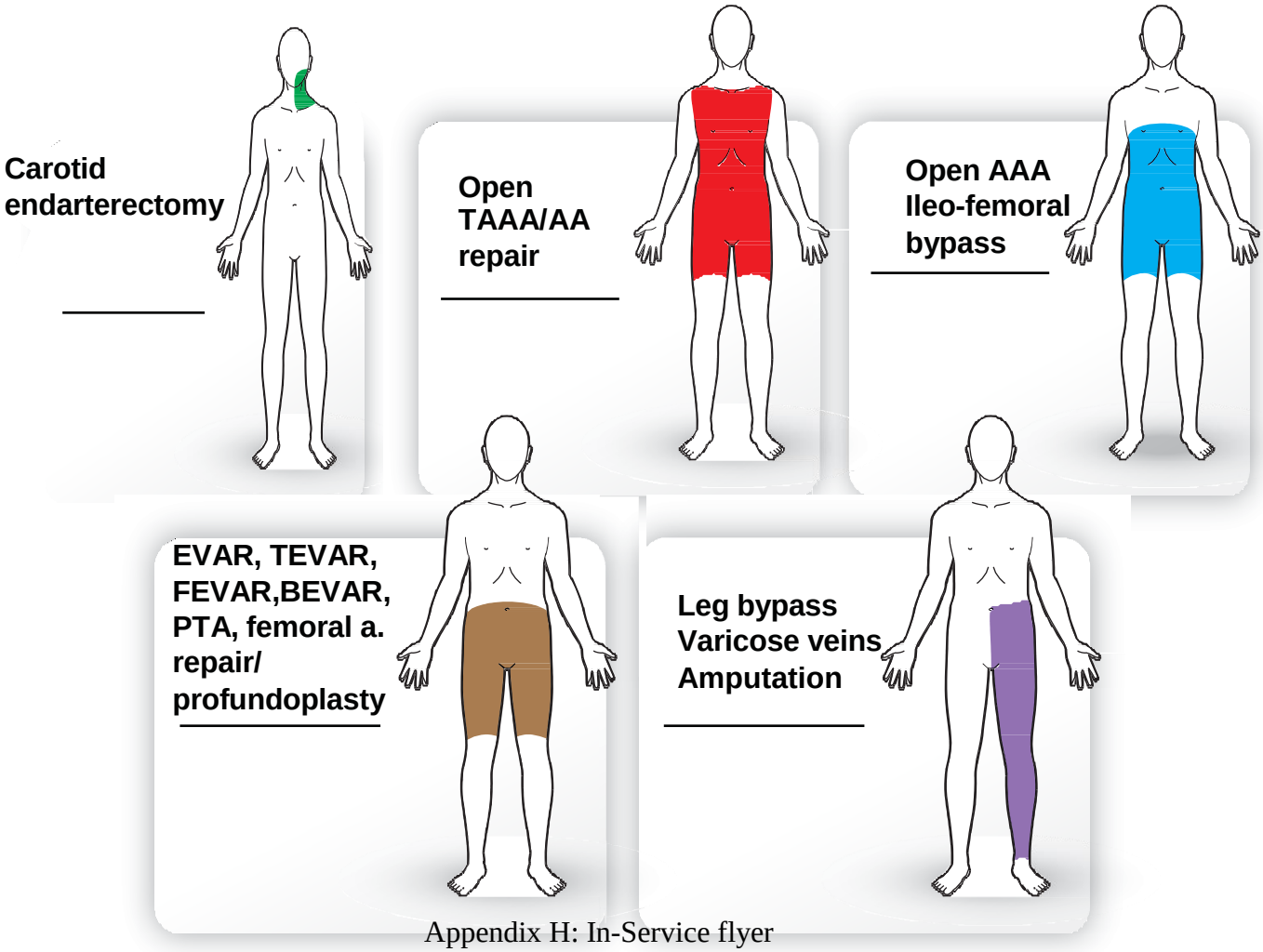
	the type of surgery	• Nurses to provide a handout to patients for their reference		

Appendix G: Vascular Pre-op Chlorhexidine Preparation

****Assess for allergy to Chlorhexidine product prior to providing instructions****

The night before your surgery

- Wash and rinse your hair using your normal shampoo. Make sure you completely rinse the shampoo from your hair and body.
- Wash your body with regular soap. Make sure you completely rinse off the soap from your body.
- Now begin using one of the scrub sponges that you purchased.
- Wash the shaded areas as shown on the diagram below according to the surgery you are having. Avoid scrubbing your skin too hard.
- Avoid close contact with eyes



Appendix H: In-Service flyer

What's New in Vascular?

1. Addition of chlorhexidine pre-op scrub in the Vascular Surgery Pre-op order set

2. "Vascular Pre-op Chlorhexidine Preparation" pre-op patient education handout

Go Live date: TBA

In-services held weekly:
Dates TBA, 0630-0650, 1130-1150, 1430-1450, 1630-1650
Dates TBA, 0630-0650, 1130-1150, 1430-1450, 1630-1650
Dates TBA, 0630-0650, 1130-1150, 1430-1450, 1630-1650

Please plan to attend one of these meetings.
Please also feel free to email me with any questions you may have.
Thank you,

Janine Duquette BScN, MN, ACNP

Appendix I: Quality Improvement Plan

Audit criteria / Quality Indicator	Sources of Data	Feedback Review of Indicator Results
Vascular SSI rates compared to other surgical specialties	NSQIP database and values entered into an excel spreadsheet.	Data will be collected by the Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP and presented quarterly to the project team
Compare Vascular SSI rates pre and post implementation of the chlorhexidine wash	CIHI DAD database and values entered into an excel spreadsheet for comparison. Raw data related to this query will also be collected by the Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate	Data will be collected by the Information Controller, Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP and reviewed and presented monthly at the project team meetings

	format in an excel spreadsheet without patient identifiers	
SSI related readmissions within 30 days of surgery	Data will be collected and reviewed from the NSQIP database and CIHI DAD database to determine if there was a reduction in SSIs and readmissions within 30 days of discharge NSQIP database and values entered into an excel spreadsheet.	Data will be collected by the Information Controller, Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP and reviewed and presented monthly at the project team meetings
SSIs within 30 days of surgery	Raw data related to this query will be collected by the Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate format in	Data will be collected by the Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP and reviewed and

	an excel spreadsheet without patient identifiers.	presented monthly at the project team meetings
Re intervention rates related to SSIs	National benchmark data will be collected and reviewed to determine if there was any re-interventions related to SSIs Raw data related to this query will be collected by the Quality Specialist and Patient Safety Specialist to enter into the NSQIP database and will present this in aggregate format in an excel spreadsheet without patient identifiers.	Data will be collected by the Information Controller, Quality Specialist and Patient Safety Specialist, who are part of the data review team for NSQIP and presented quarterly to the project team

Appendix J: Staff Survey Results by Theme

1. What is new to the preoperative care of vascular patients?

   Preoperative wash / chlorhexidine scrub

   Orders in the order set for vascular patients

2. Where will the chlorhexidine wash be implemented?

   All preoperative areas

   Patient's home

   Inpatient unit

   Day surgery

3. Who will administer the chlorhexidine wash?

   Patients

   Nursing staff working in day surgery

   Nursing staff working on the inpatient unit

4. When will the chlorhexidine wash be ordered to be applied?

   The night before and morning of surgery

   Morning of surgery

5. Why is the chlorhexidine wash important for patient care?

   To prevent infections

To treat high rates of infection

Appendix K: The Flesch Reading Ease Readability Formula (2016)

This formula is primarily used to assess the reading difficulty of passages written in English. It is a standard formula used to assess readability and is used by many U.S agencies, including Microsoft Word.

The Specific Mathematical formula is:

$$RE = 206.835 – (1.015 \times ASL) – (84.6 \times ASW)$$

RE= Readability Ease (ranging from 0-100)

ASL= Average Sentence Length (Number of words divided by number of sentences)

ASW= Average syllables per word (number of syllables divided by the number of words)

Scores between 90-100 are considered easily understood by an average 5th grader

Scores between 60-70 are considered easily understood by an average 8th or 9th grader

Scores between 0-30 are considered easily understood by college students

90-100 : Very Easy

80-89 : Easy

70-79 : Fairly Easy

60-69 : Standard

50-59 : Fairly Difficult

30-49 : Difficult

0-29 : Very Confusing

When applying this formula to the patient education material, a score between 90 and 100 was generated. This confirms its readability to be consistent with that of a 5^{th} grader.

Calculation:

ASL

Number of words = 82

Number of sentences =9

= 9

ASW

Number of Syllables = 102

Number of words = 82

= 1.2

RE= 206.835 - (1.015 x 9) – (84.6 x 1.2) = 206.835-9.1-101.52 = 96.2

Appendix L: Getting to Outcomes (GTO) Program Evaluation Tool

Planning Questions

1. Needs and Resources. What are the underlying needs and conditions in vascular?
    - To address the high rates of Surgical Site Infections in the Vascular population
    - Improve patient quality care
    - Reduce hospital readmissions related to infections
    - Underlying needs involve patient and staff education, ensuring availability of the chlorhexidine scrubs in all preoperative areas
2. Goals. What goals, target populations and objectives will address the needs and change the underlying conditions?
    - The goal identified is to reduce the rates of SSI by 25% within 1 month post implementation.
    - The target population is the patients scheduled to undergo vascular surgery
    - The objective is to implement a chlorhexidine wash preoperatively in all vascular patients scheduled to undergo surgery
3. Best Practice. Which evidence-based models and best practice programs can you use to reach your goals?
    - The NICE (2008) *Surgical Site Infections: Prevention and Treatment Guidelines*
    - The CDC (1999) *Guideline for Prevention of Surgical Site Infection*
    - The CPSI *Safer Healthcare Now* (2014) guidelines aimed to *Prevent Surgical Site Infections*

4. Fit: What actions do you need to take so that the selected program "fits" the vascular context?
    - Create a patient education handout that is at a readability level 5 for patient understanding
    - Schedule, coordinate and provide in-services to nursing staff in the Preoperative Clinic, Day Surgery, and Vascular Inpatient unit to educate nursing staff on the upcoming changes that will be effective upon implementation of the Chlorhexidine wash
    - Gain approval to obtain and use aggregate data from the NSQIP committee, Program director, and Ethics board within the practicum site.
5. Capacities. What organizational capacities are needed to implement the program?
    - Purchase and ensure the chlorhexidine scrubs are available in the preoperative areas, as well as the pharmacy for patients to purchase after their preoperative clinic visit
6. Plan. What is the plan for this program?
    - To pilot the use of a chlorhexidine scrub preoperatively in the vascular population to reduce SSIs, and then create social change among the other operative services to ensure it is used hospital wide.

Evaluation Questions

7. Process. How will you assess the quality of program implementation?

- The program quality will be assessed using raw aggregate data to capture and compare SSI rates pre, and 1 month post implementation of the chlorhexidine to see if a change has occurred.

8. Outcomes. How well did the program work?
    - The program was implemented in an organized fashion. Nursing staff easily adopted the new procedure and the overall compliance rate was high. A reduction in SSI was already seen at 1 month post implementation.

Sustainability Questions

9. Continuous Quality Improvement. How will you incorporate continuous quality improvement strategies?
    - Quality improvement will be ongoing with this project through regular meeting to present the data on SSIs in Vascular and promoting this practice change among other surgical specialties
10. Sustainability. How will effective programs be sustained?
    - Through ongoing review and feedback of outcomes presented to executive team members, as well as the staff in the preoperative areas.