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Cesarean Section Surgical Site Infection Prevention Evidence-Based Practices and Implementation Plan

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Table of Contents

Table of Contents 2
Abstract 4

Chapter One: Introduction and Microsystem Assessment 5
Introduction to the Microsystem 5
Defining the Clinical Problem 6
Necessity for Improvement in the Microsystem 8

Chapter Two: Literature Review 11
Defining the Clinical Problem 11
Incidence and Significance of Surgical Site Infections 12
Literature Review 13
Perioperative Guidelines for Surgical Obstetric Patients 14
Surgical Site Infection Prevention Bundled Care 15
Pieces of the Bundle Improve Outcomes 17
Risk Factors 19
Summary of Current Literature 19

Chapter Three: Conceptual Model 21
The Nursing Role Effectiveness Model 21
Structure 21
Process 22
Outcomes 23
Framework for Assessing Surgical Site Infections 23
Conclusion 25

Chapter Four: Clinical Protocol 27
Purpose of the Project 27
Needed Resources 28
Measurement of Bundle 29
Quality Improvement Process 30

Conclusion 32

Chapter 5: Clinical Evaluation 33
Implementation Process 33
Data Collection 33
Proper Discharge Instructions 34
Terminal Cleaning 34
Proper Surgical Attire 35
Surgical Site Infection Prevention Bundle 36
Recommendations 36
Successes and Difficulties 37
Barriers 38
Changes and Sustainability of Current Practices 38
Strengths and Weaknesses of the Project 39
Evaluating Outcomes 39
Implications for Practice Discussion about other EBP and Trends 41
Project Limitations 41
Reflections of the CNL Essentials 41
Conclusion 44

References 45

Appendices 50

Abstract

The Cesarean section (C-section) surgical site infection prevention implementation plan has been designed as a quality improvement project. The project included a microsystem assessment, identifying the problem, literature review, application of a nursing theory and conceptual model, and development of an implementation plan. The microsystem assessment involved a Labor and Delivery Unit who had initiated a new surgical site infection (SSI) prevention bundle developed by an interprofessional team utilizing evidence-based practices and other hospitals protocols. The problem defined was the elevated rates of SSIs due to gaps in the SSI bundle risking the sustainability of the bundle. A literature review was performed by searching CINAHL with the search terms: surgical site infection, cesarean section, and obstetrical surgery. The time frame chosen for the literature review was 2011-2016. The Nursing Role Effectiveness Model was utilized to assess the current unit structure and processes to evaluate related outcomes. Furthermore, the implementation plan was formulated with the idea of rapid cycle change utilizing the Plan-Do-Study-Act (PDSA) cycle. Collaboration with interprofessional teams and key stakeholders is essential for the success and sustainability of this project.

Keywords: Cesarean section, C-section, obstetrical surgery, SSI, quality improvement, gap analysis, Nursing Role Effectiveness Model, and PDSA

Chapter One: Introduction and Microsystem Assessment

Healthcare is more complicated than ever before. There has been a shift from the old thinking of the doctor knows best to the need for quality outcomes. Volland (2014) identifies healthcare reform is focusing on patient experience and clinical outcomes and hospitals are having to change their processes to comply. For hospitals to change, they must start by assessing the culture and processes effecting data and reimbursement. To do this one must understand the complex systems nurses and healthcare providers work in. Lindberg, Nash, & Lindberg (2008) identify complexities within hospitals have progressively changed due to patient acuity, changes in technology, budgetary confinements, and nursing shortages.

One technique to assess hospital complexities is to assess the clinical microsystem. A clinical microsystem is identified by Nelson, Batalden, Godfrey, and Lazar (2011) as a system where a small group of people work together consistently providing care for subpopulations of people. Furthermore, the functioning units have specific aims or goals, processes, and have care that is measurable (Nelson, Batalden, Godfrey, & Lazar, 2011). A microsystem assessment looks at the people, purpose, patients, professionals, processes, and patterns of the unit (Nelson et al., 2011).

The purpose of this paper is to identify and introduce the clinical microsystem and provide background information and relevance to help define a clinical problem and intervention purposed for quality improvement.

Introduction to the Microsystem

The microsystem being assessed is a Labor and Delivery (L & D) unit. The unit is part of large health system in mid-Michigan that had over 4,200 deliveries in 2016. The unit consists of

twelve beds and the average length of stay is twelve hours. Additionally, there are three surgical suites in the department.

The patient population on the L & D unit is very specific. Patients admitted to this unit are of childbearing age, pregnant, and up to six weeks post-partum. The most common diagnosis seen on this unit are spontaneous or induction labor, hypertension, cesarean section, pre-eclampsia, and fetal loss. Most often, patients are transferred to the Mother Baby Unit two hours after delivery. The L & D unit staff consists of registered nurses (RNs), surgical techs, a unit manager, educator, and Clinical Nurse Specialist (CNS). Staff works very closely with physicians, anesthesia, and performance improvement specialists to collect essential data, identify gaps, and improve patient outcomes.

Defining the Clinical Problem

Surgical site infections are a common complication of surgery. According to the Center for Disease Control (CDC, 2016), surgical site infections (SSI) are the most common healthcare-associated infection. On the L & D unit, a surgical site infection (SSI) prevention bundle was formulated and initiated in 2016 based on evidence-based practices.

Cesarean section rates have been on the rise in recent years (Menacker & Hamilton, 2010). "Cesarean delivery remains the most common operating room procedure in U.S. Hospitals" (Hickson, Harris, & Brett, 2015, p. 174). According to Menacker and Hamilton (2010), the C-section rates has risen 53% between 1996 and 2007. With the suggested increase in C-section rates, there is also increased incidence of surgical site infections.

The obstetric C-section patient population presents with unique attributes when they acquire a SSI. Outcomes not only affect the patient and newborn, but also impact family members who are dependent on the patient. This is important as many hospitals have moved to

baby friendly initiatives to help promote breastfeeding. Baby friendly initiatives encompass many aspects and breastfeeding is one important aspect as it has been proven successful at reducing the rate of infection in the newborn (Ip et al., 2007). If the patient is sick she may not be able to care for her baby in the way she intends.

C-sections are a major abdominal surgery and present risk of complications for the mother and baby that potentiates the risk for increased costs (Menacker & Hamilton, 2010). Readmissions due to surgical infections have been estimated to cost approximately $50,000 (Hickson et al., 2015). Readmission costs are a large motivator to ensure a reduction in infection rates. Patients with SSIs do not always get readmitted, but utilize a significant number of resources including physician office or emergency department visits. Although C-section SSIs are not currently reportable data, other SSIs are, and hospital reimbursement is based on quality outcomes. Predicting future reimbursement allocations makes it necessary to look at SSIs related to C-sections and see how the rates can be decreased. Financial incentives may seem to drive patient outcomes, but organizational goals include providing quality care to all patients.

The National Healthcare Safety Report identifies the average national rate of SSI for C-sections range from a pooled mean of 1.46-3.82 (Edwards et al., 2009), and Hsu, Cohn, and Caban (2016) found SSI rates in cesarean sections to range from 3- 15% nationally. Increased rates of infection cause poor outcomes for patients such as morbidity, mortality, and prolonged hospitalization (CDC, 2016). Furthermore, 12 % of maternal deaths are associated with C-sections (Witter, Lawson, & Ferrell, 2014). Kilpatrick and Berg (2016) further support this evidence by articulating there has been an increased number of maternal deaths even in the United States, a developed country with bountiful healthcare resources. The rate of surgical site infections (SSI) in 2015 was 2.68 per 100 surgeries. A surgical site infection prevention bundle

was implemented on the L & D unit in 2016 and rates of SSI in C-section patients decreased to 1.76 per 100 surgeries for the entire year. The rate of SSIs reported from January through May 2017 reveals a rate of 2.73 per 100 surgeries. The goal for SSI rates has been established for this hospital at 1.07 per 100 surgeries based on national data.

Necessity for Improvement in the Microsystem

A complication of any surgical procedure is an infection related to the surgical site. Obstetric patients who have C-sections are not exempt from infection risks. The local hospital collects SSI data and reports to the Centers for Medicaid and Medicare Services (CMS). SSIs are one of the hospital acquired conditions (HAC) monitored and linked to reimbursement (CMS, 2015). However, C-section data is not required to be reported to CMS for SSIs. Although SSI rates in C-sections were noted in 2015 by the hospital's Obstetrics and Gynecology (OB/GYN) Department as above the mean for the national average and currently remain elevated.

Furthermore, The Joint Commission monitors the rate of HAC scores including infections. The hospital rate of SSIs were high and the score related to C-sections was higher than established HAC goals. This was identified as an opportunity for improvement and the OB/GYN department set forth the task of implementing a SSI bundle to improve patient outcomes and decrease SSI rates. In 2015 a decision was made to implement a SSI bundle because current C-section SSI rates were 2.68 per 100 surgeries. The National Healthcare Safety Network (NHSN) report in 2009 identified 1.07 as a 50^{th} percentile goal and the hospital adopted this target (Edwards et al., 2009).

A literature review was performed, baseline data was collected, and protocols from other institutions were evaluated. Based on these evidence-based practices, the SSI bundle was developed for the L & D staff by an interdisciplinary team of physicians, anesthesia, Clinical

Nurse Specialist (CNS), and Clinical Nurse Leader (CNL). Before implementation, staff was trained through required simulation labs over a period of several weeks. The staff was provided with a packet of information and performed aspects from the SSI bundle on a manikin to show and validate competency. The aspects demonstrated were vaginal preparation, Chlorhexidine skin preparation, and proper removal of the ultrasound gel. It was then expected proper that techniques would be implemented into practice.

Unfortunately, even with implementation and standardization of the SSI bundle, there is still an elevated rate of infections. Through a microsystem assessment, inconsistent and uncertain practices associated with the C-section SSI bundle were identified. The current C-section SSI rate is 2.73 per 100 surgeries year to date. Significant reluctance from physicians and nurses was observed. The problem may be due to variation in the implementation of the bundle and lack of consistent resources. There is a need to further assess the current state of the SSI bundle implementation and the barriers to proper usage of the bundle.

Patients who experience severe post-partum complications are readmitted directly to the Labor and Delivery Unit up to six weeks postpartum. One of the frequent readmissions to the unit was identified by the department manager as SSIs. Patients with SSIs from their cesarean sections present with multiple different symptoms. Some surgical infections have progressed to sepsis requiring intensive care unit admissions. This is costly for the patient and hospital and compromises the wellbeing of the mother and baby.

Patients diagnosed with SSIs are not always admitted to the hospital. However, patients with SSI are typically diagnosed after discharge. Patients receive follow-up care at OB/GYN offices, primary care physicians, emergency departments, or urgent care centers. SSI data is collected from the patient's physician offices and diagnosis codes from outpatient and inpatient

settings to equate the current rate of infection. Data collection has been identified as a barrier and the SSI team has worked with OB/GYN offices in 2017 to streamline the data collection process.

Consistent elevated rates of infection, poor patient outcomes, and financial responsibility for the hospital are key reasons to assess practice and ensure care provided is consistent and evidence-based. According to Shepard et al. (2013), patients who are readmitted with an SSI tend to have increased daily costs, increased length of stay, and increased 30-day readmission rates. Assessing patterns and gaps in performance of the SSI bundle can be done easily. Once patterns are assessed and variations identified, barriers can be addressed. There are many stakeholders who are integral in helping make necessary changes. Stakeholders include high performing nurses, surgical scrub technicians, physicians, and nursing leaders. Gaining buy-in was identified as a barrier when the SSI bundle was implemented in 2016.

The proposed intervention is a gap analysis through observation and analyzation of variation in SSI preparation in patients undergoing scheduled C-section. Standardizing processes will be necessary and implementing resources to help sustain the change. Furthermore, working with the data team and informatics nurse will help identify the largest areas of need.

Chapter Two: Literature Review

Surgical site infections are a common complication of surgery. According to the Center for Disease Control (CDC), surgical site infections (SSI) are the most common healthcare-associated infection (CDC, 2016). Implementing changes in the workplace can be challenging and ensuring evidence-based practices are utilized is essential in providing quality outcomes for patients. A literature review was conducted utilizing the database CINAHL with the key words surgical site infection, cesarean section, and obstetrical surgery. The time frame utilized for the search was 2011-2016 and English was the selected language. The purpose of this chapter is to present the current state of knowledge based on literature for SSI prevention in Cesarean sections (C-section).

Defining the Clinical Problem

A complication of surgical procedures is the risk of infection and obstetric patients are not exempt. The local teaching hospital in mid-Michigan has been collecting SSI data and reports to the Centers for Medicaid and Medicare Services (CMS) for hysterectomies. Currently, C-sections infection rates are not required as reportable data. Hysterectomies are performed in the main Operating Room (OR) and C-sections occur in the Labor and Delivery OR. The surgical site infection prevention bundle was developed as an intervention to standardize care throughout all the operating room practices for obstetrical and gynecological patients. SSI rates in C-sections has been noted by the hospital's Obstetrics and Gynecology (OB/GYN) Department as being above the mean for the national average. The rate of surgical site infections (SSI) in 2015 was 2.68 per 100 surgeries. A surgical site infection prevention bundle was implemented on the L & D unit in 2016 and rates of SSI in C-section patients decreased to 1.76 per 100 surgeries for the entire year. The rate of SSIs reported from January through May 2017

reveals a rate of 2.73 per 100 surgeries. The OB/GYN group established a goal based on data to be 1.07 based on NHSN 50th percentile data (Edwards et al., 2009). Although a SSI bundle has been implemented, routinely not all of the aspects of the bundle are completed as identified through chart audits. Surgical site infections are costly and can cause readmissions or prolonged length of stay for patients.

An interprofessional team of physicians, anesthesiologists, clinical nurse specialists, and a clinical nurse leader reviewed the literature, evidence-based practices, and other hospitals' protocols to develop the current SSI bundle. Best practices have been implemented with very little change in the rate of SSIs. Variation in implementation of the SSI bundle may be a contributing factor to explain why the infection rates have not changed. The initial question purposed is what are the current practices and what are the ideal practices. Clearly identifying the gaps in practice will help understand the variation and deviation of the bundle.

Incidence and Significance of Surgical Site Infections

Cesarean section rates have increased by 53% between 1996 and 2007 (Menacker & Hamilton, 2010). "Cesarean delivery remains the most common operating room procedure in U.S. Hospitals" (Hickson, Harris, & Brett, 2015, p. 174). The risk for increased incidence of surgical site infections is likely when there is an increased rate of C-sections. Hsu, Cohn, and Caban (2016) have found SSI rates in cesarean sections range from 3- 15% of live births nationally. In addition to poor outcomes for patients, surgical site infections are associated with mortality rates of 12% in maternal adults who undergo a cesarean section (Witter, Lawson, & Ferrell, 2014,). Kilpatrick and Berg (2016) further support this evidence by articulating an increased number of maternal deaths even though the U.S is a developed country with bountiful healthcare resources.

C-sections are a major abdominal surgery and present risk of complications for the mother and baby that potentiates the risk for increased costs (Menacker & Hamilton, 2010). Readmissions due to surgical infections have been estimated to cost approximately $50,000 (Hickson, Harris, & Brett, 2015). Readmission costs are a large motivator for hospitals to ensure a reduction in infection rates. Although C-section SSIs are not currently reportable data, other SSIs are, and hospital reimbursement is based on quality outcomes. Predicting future reimbursement allocations makes it necessary to look at SSIs related to C-sections and see how the rates could be decreased. Financial incentives may seem to drive patient outcomes, however, organizational goals include providing quality care to all patients and is of utmost importance.

Literature Review

Surgical site infections are a well-documented problem with adverse outcomes. Many studies have been performed to affect quality patient outcomes and reduce the incidence of SSIs. The complexity of SSIs are far beyond obstetrical patients, and evidence-based guidelines have been designed to establish best practices and reduce SSI rates. Fortunately, studies have been performed to assess, analyze, and reduce rates of SSI in patients who undergo C-sections. (See Appendix A).

Many agencies have produced guidelines for surgery making bundles and practices cumbersome and difficult to follow. Recently, a team from the World Health Organization (WHO) collaborated to provide standardized guidelines. The team published two articles defining preoperative, intraoperative, and postoperative evidence-based recommendations as a global approach by considering cost-analysis and product availability to balance benefits and harm. The guidelines by Allegranzi et al. (2016) utilized current literature to define problems related to topics associated with SSI reduction. The guidelines are expert opinion and utilized a

structured meta-analysis process to provide recommendations for practice that are consistent worldwide. The WHO guidelines provide the quality of evidence utilized to determine the current recommendations.

Similarly, a study by Pellegrini et al. (2017) compiled practice guidelines specific to gynecologic surgeries. The experts recognized despite efforts to reduce SSI rates, infections are still prominent and may pose a unique threat to obstetrical patients. Pellegrini et al. (2017) compiled data to provide evidence-based practice recommendations in a bundle format. The authors divided the bundle into four sections: readiness, recognition and prevention, response, and reporting and systems learning, to support implementation within acute care settings.

Perioperative Guidelines for Surgical Obstetric Patients

Clinical practice guidelines are often an effort to collaborate evidence into a practical form for best utilization and implementation of practices (Polit & Beck, 2017). The scope and purpose of the clinical guideline *Perioperative care of the pregnant woman. Evidence-based clinical practice guideline* was identified and set forth for patient safety and quality improvement (AWHONN, 2011). The guideline was created to provide health professionals a clinical recommendation to ensure pregnant woman receive evidence-based care similar to all other surgeries in patients who are not pregnant (AWHONN, 2011). The target patient population was obstetrical surgical patients , and the intent was to identify risks to mitigate complications to improve quality, patient safety, and outcomes.

The guideline identified nine different interventions and practices for consideration. The Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) identify pregnant women who have surgery during their pregnancy and for delivery including the operative phases as the target population for the clinical guideline (AWHONN, 2011). Additonally, immediate

care of the newborn is also addressed in the guideline. The authors also acknowledged patient safety, non-obstetric surgery during pregnancy, pre-operative education for a surgical birth, special considerations for unscheduled surgical births, considerations for obese patients, and assessment of deteriorating conditions as important practices to establish evidence-based care guidelines for healthcare professionals.

Although there were limitations to specifics to the clinical practice guidelines (CPG), they apply to the current clinical problem. One identified limitation to the CPG was the lack of specificity for interventions. To address this limitation, focused literature reviews should be used in collaboration of the CPG to establish best practices. Some research is limited by location which may make it hard to generalize standards. Nevertheless, assessing and applying high-level evidence and interventions associated with the guidelines may help reduce SSI. Furthermore, several of the articles found in the literature review, discuss variation in practices and establishing standardization which will help decrease variation of care.

Surgical Site Infection Prevention Bundled Care

Bundles are complex and incorporate many facets to have best practices established in a clear, concise manner with the quality of evidence supporting the benefits. Anderson et al. (2014) strived to provide a clear and concise approach to aid hospitals in ensuring current practices are up-to-date and compliant with all agency regulations. This article provided guideline information and utilized recommendations from the Centers for Disease Control (CDC), Healthcare Infection Control Practices Advisory Committee (HICPAC), National Institute for Health and Clinical Excellence (NICE), Surgical Infection Prevention (SIP) Project, Surgical Care Improvement Project (SCIP), Institute for Healthcare Improvement (IHI), The

Joint Commission National Patient Safety Goals, and federal requirements based on the Centers for Medicare and Medicaid Services (CMS).

In *Strategies to Prevent Surgical Site Infections in Acute Care Hospital: 2014 Update*, Anderson et al. (2014) define the optimal surgical site infection prevention bundle. Key components of the SSI bundle include the pre-operative care of antimicrobial prophylaxis, hair removal, blood glucose control, alcohol-containing preoperative skin preparatory, and surgical checklists based on the WHO checklist to ensure compliance with best practices to improve surgical patient safety. Intraoperatively, the recommendations made in this article are the use of impervious plastic wound protectors for gastrointestinal and biliary tract surgery. Lastly, suggested post-operative care includes normothermia, optimizing tissue oxygenation following surgical procedures involving mechanical ventilation, and again blood glucose control. After patient discharge it is necessary for surveillance of SSIs, efficiency of surveillance through utilization of automated data, ongoing communication of SSI rates to surgical and perioperative personnel and leadership. Measuring data and providing feedback to providers regarding rates of compliance with process measures, educating surgeons and perioperative personnel about SSI prevention, educating patients and their families about SSI prevention, and ensuring policies and practices are implemented which are aimed at reducing the risk of SSI that align with evidence-based standards. This article also provides recommendations for risk factors and special considerations associated with SSIs.

A study by Hsu, Cohn, and Caban (2016) demonstrated the effects of obtaining baseline surveillance data and implementing all aspects of the SSI bundle in increments to sustain and change practices. The approach by Hsu, Cohn, and Caban (2016) implemented an infection control policy (jewelry restriction for staff, appropriate closure of operating room door,

prohibition of long sleeves in pediatrician attire in the OR, hand hygiene compliance, placement of alcohol dispensers in patient bathrooms, administration of proper antibiotic within one hour of surgery, chlorhexidine (CHG) utilization for skin prep, and multidisciplinary team education) initially. The next step used was to sustain current infection control policies and then implement evidence-based pre-surgical checklist of SSI reduction bundle and then monitor rate and sustainability. This remarkable project included over 3,000 surgeries and was monitored over six years. Rate of infection for C-sections of 6.2% were decreased to 0.1%. Continued monitoring is planned.

Pieces of the Bundle Improve Outcomes

Through the literature review, it is evident implementing elements of an SSI bundle improve patient outcomes. Gregson (2011) implemented changes to practice and improved protocols for dressings postoperatively and changed hair removal to hair clipping in an attempt to comply with the National Institute for Health and Clinical Excellence (NICE) guidelines. The study decreased infection rates in two clinical site which averaged between 5.7-9.0% down to 1.3% and 3.8% based on the two interventions. Another study found changing skin prep to recommended CHG solution, changing antibiotics, and educating staff on SSI changes decreased the SSI rates at one hospital from 6.9% to 3.3%.

Another study was able to implement changes to practices based on systematic chart reviews to determine areas which increased the risk for SSI. Hickson, Harris, and Brett (2015) explained how one hospital worked to improve outcomes by teaching hand hygiene and basic infection prevention to patients, hair removal performed by clipping rather than shaving, patients asked not to wear makeup or jewelry, changing pre-op skin prep changed to CHG, careful removal of drapes, utilizing sutures instead of staples, standardizing pre and post-op protocols,

post-op dressing was changed on day three, and new high-risk dressing and negative wound pressure therapy. By implementing these interventions, the SSI rate went from 2.13% to 0.10%. Whereby changing preoperative skin preparation and antibiotics were found effective in a study by Henman et al. (2012). Changing current practices and implementing suggested guidelines, the Australian hospital was able to decrease SSI rates from 6.9% to 3.3%. The researchers found a decrease in the incidence of SSIs, readmission rates, length of stay, and improved patient outcomes.

Several other studies have implemented changes and found success related to small modifications in their current SSI bundle. Holland, Foster, Ulrich, and Adkins (2017) focused on patient and staff hand hygiene education, CHG skin preparation, development of numerous educational pieces for staff, including postoperative wound care videos. The quality improvement project was successful and was able to decrease the rates of infection from 1.35% to 0.36% in two years.

A study focused on gynecologic surgeries was performed to assess intervention beyond recommended SSI guidelines and was found to be successful. The retrospective and prospective study performed by Johnson et al. (2016) utilized new closing trays, glove changes for fascia and wound closure, dressing removal between 24 and 48 hours, and patients were discharged with 4% CHG solution for wound care, and given a follow-up call from nursing. Overall reduction was evident as the overall rate of SSI was 6.0% before additional bundled interventions was decreased to 1.1%. This study was particularly intriguing as the facility was already following best-practice guidelines.

Risk Factors

Risk factors are another area identified in the literature as needing to be identified for special considerations for surgery. Risk factors are mentioned by Hickson, Harris, and Brett (2015), Henman et al. (2012), Anderson et al. (2014), and Pellegrini et al. (2017). Patients who have identifiable risk factors for developing SSIs after surgery need to have special considerations. One of the major risk factors identified in these bodies of literature is obesity. Obesity increases postoperative complication by as much as 20 % (Hickson, Harris, & Brett, 2015). Further analysis is needed to establish if race or ethnicity is a risk factor. Other risk factors include age, diabetes, smoking, immunosuppressive medications, and changes to the operative plan is necessary (Anderson et al., 2014). Pregnant women often have many of these risk factors. The current bundle at this hospital in Mid-Michigan does not define special considerations for high-risk patients.

Summary of Current Literature

The literature review presents many interventions for decreasing rates of SSIs. Guidelines have been established to help identify greatest areas of need. Guidelines are cumbersome, and some lack sufficient evidence for harm and benefit comparison. Although guidelines act as a starting point, they may not meet the needs of all who undergo surgery.

It is easy to see a reduction of SSI rates when interventions are implemented, but the literature does not make it easy to assess which interventions have the most beneficial effect on patient outcomes. Bundled care is a collaboration of best-practices, and some practice may have more benefit than others. It is difficult to compare results for SSI bundle implementation when there is variability of the interventions.

Risk factors for surgery are global, but specific rates of high-risk patients are not identified in the literature. Many of the studies include surveillance of the data to assess their greatest needs before implementing new practices. Clear communication to patients and staff was a common theme in implementation processes. One limitation to current literature is the difficulty in collecting accurate data. Data for SSIs are often collected by physicians or upon readmission to the hospital. Self-reporting for patients is not a reliable source and ensuring proper identification of infection is also pertinent.

The overall evidence supports following the EBP guidelines and SSI bundles in its entirety. Major components of the bundle seem to be specific antibiotics and antibiotic administration within one hour of the incision, hair removal done by clipping and not shaving, and CHG utilization for skin prep. These major components are included in the local hospital's guidelines, but several gaps are noted in the current bundle practices. Currently, temperature regulation is not closely monitored, and glucose control has not been identified as a pertinent step preoperatively. Furthermore, several of the articles emphasized patient education on hand hygiene and wound care. Further assessment of these components may reveal improved patient outcomes.

Chapter Three: Conceptual Model

Implementing changes in the workplace can be challenging. A surgical site infection (SSI) prevention bundle has been formulated by an interprofessional team and initiated on the Labor and Delivery Unit based on evidence-based practices, but very little change in SSI rates have been noted. The Nursing Role Effectiveness Model (NREM) created by Irvine et al. (1998) utilizes practices and contributions the nurses make in practice to effect patient outcomes (Doran, 2011). This chapter outlines how the NREM can be used to guide practice change to ensure the SSI bundle is being utilized appropriately, is effective, and practice change will be sustained in the labor and delivery unit which serves patients pre-operatively, intraoperatively, and for a short recovery period.

The Nursing Role Effectiveness Model

Identifying a model for all the phases of a project which include the planning, implementation, evaluation, and sustainability is essential. Nurses are key players in process changes on their unit and their work directly effects patient outcomes. Doran (2011) identifies the Nursing Role Effectiveness Model (NREM) as being generated "to identify the contribution of nurses' roles to outcome achievement" (p. 14). A nurse's actions, performance, beliefs, and knowledge can shape how the nurse practices in a clinical setting. The NREM is similar to Donabedian's model of structure-process-outcome, but dives deep into each of the three sections to assess and define exactly what the components of structure-process-and outcome entail (Doran, 2011).

Structure

The first component of the Nursing Role Effectiveness Model is structure. Assessing the structure of an organization and unit is the foundation for practice. The structure component

evaluates the patients, nurses, and organizational variables that may impact process (Doran, 2011). A deeper look into each variable reveals the patient needs to be broken down into age, diagnosis, functionality, and co-morbidities of the patient population (Amaral, Fereira, Cardoso, & Vidinha, 2014). The nursing variables include nursing experience, educational mix, and skill level of the nursing staff (Amaral et al., 2014). Finally, the organizational aspects to be considered are work environment, workload including staffing, staff mix, and assignments (Doran, 2011). The structure of a work environment is integral to work processes. A Clinical Nurse Leader (CNL) can perform a microsystem assessment on the unit to assess and gather unit information and begin understanding the structure of the unit, patient population, formal and informal leadership, team interactions, current evidence-based practices utilized, culture, and desired outcomes.

Process

Processes can be hard wired, but aspects of the process may cause variations in practice. In the NREM model, the process component consists of the independent role, medical care-related role, and the interdependent roles of nurses (Doran, 2011). The independent role looks at nursing interventions or actions nurses take independently (without written orders) and how they may affect the processes (Doran, 2011). Doran (2011) continues to explain the medical care-related aspects of the NREM is correlated with the actions based on written orders or protocols. Lastly, the interdependent component that is considered is the care coordination and interdisciplinary teams that could be affected by clear communication (Doran, 2011). Understanding process is an important piece of a team's success in producing quality outcomes.

Assessing and understanding the process is very important for this clinical problem. There is variation in the SSI bundle and it is necessary to monitor trends. The model will help to

consider the unit and process considering all roles in the process to assist in identifying patterns of variation. The NREM is not inclusive to nursing, but rather assists in looking at all steps where breakdown can be affected.

Outcomes

Providing quality outcomes to patients is the ultimate goal, but many factors affect outcomes. The NREM strives to look into variables affecting outcomes. Outcomes are often affected by the nursing role and are measured and reported as nurse-sensitive outcomes. Nurses play an integral part of patient outcomes. Nursing interventions and actions affect prevention of adverse effects, clinical outcomes, patient education of diseases, and diagnosis including signs and symptoms of exacerbations, medication education and side effects, and cost of care (Doran, 2011). Furthermore, Doran, Sidani, Keatings, and Doidge (2002) identify outcome variables to include "the patients' health status, the patients' perceived health benefit from nursing care, and the direct and indirect costs associated with nursing care" (p. 31). Outcomes are affected by the structures and process set forth as the foundation of care.

Framework for Assessing Surgical Site Infections

An interprofessional team on the Labor and Delivery Unit has identified surgical site infections in C-section patients as a problem and a bundle been initiated in 2016. The SSI bundle was created based on evidence-based practices. Although the SSI bundle was implemented, SSI rates have not changed and it is not clear why. The Nursing Role Effectiveness Model strives to show how nursing actions can effect patient outcomes. The NREM can be utilized to address the problem of SSI in obstetric patients by providing a framework to assess the structure and processes that influence patient outcomes (See Appendix B). The patient outcome affected in this case would be rates of SSI. The ultimate goal is to decrease the current

rate of infections. SSIs create adverse patient outcomes including increased length of stay, cost, and mortality. Analyzing specific structure and processes within the SSI bundle will provide valuable information for outcome management and sustainability of evidence-base interventions.

Structure is the first aspect of the model that is important to consider. The patient population includes female, obstetric patients undergoing scheduled C-sections. The patient's ages vary and SSI can occur in any patient who undergoes surgery, but it is necessary to consider and analyze co-morbidities and risk factors such as obesity and diabetes rates in the maternal patients. Other factors in the structure would be the nurses' level of experience and appreciation on how it correlates with the outcome. Moreover, it is important to consider the education preparation of the nurses and the education or orientation provided about SSI. The SSI bundle is a key driver of nursing interventions and actions that influence patient outcomes. Last, assessing the work environment in the L & D operating rooms is pertinent to the patient outcomes since the environment must be compliant with safety standards. Cleanliness, space, and temperature regulation are all important aspects of the work environment that can assist in prevention of SSIs.

Looking at the process component of the SSI bundle, the SSI bundle offers detail that reflects strengths and breakdowns in the process. The process component also considers interdisciplinary involvement, communication, and handoffs that support or impede the bundle. When assessing independent nursing practice, monitoring behaviors such as nursing actions that deviate from the written bundle or gaps in bundle adherence help address variation in care. Nurses make clinical decisions based on their knowledge and skill, and this may correlate to the nurse's knowledge and educational framework of the SSI bundle. Additionally, assessing how well the orders and SSI bundle are adhered to could also be pertinent factors in patient outcomes. For example, assessing if the nurses are administering the antibiotic within the allotted time

frame as specified by the institution's bundle and physician's orders could be an important aspect of compliance to orders. Lastly, ensuring order sets comply with the bundle initiated would be another important factor to deterimine.

The interdependent role is the final component of the NREM. Doran (2011) defines the interdependent role as the interactions of interdisciplinary team members and the coordination of care. Although the NREM links nursing interventions to outcomes, the care coordination and interdisciplinary piece of this framework play a very important role in outcomes as it highlights communication and handoffs. Things to consider would be clear communication in the operating room, clear communication between nursing staff, physicians, and anesthesia, and clear communication among nurses and nursing units. In the case of this hospital in mid-Michigan, patients transfer from L & D to the Mother Baby Unit. Communication such as nursing handoff between units may be one factor to consider as patient education about wound care and hand hygiene may also prove to decrease the risk of infections (Hickson, et al., 2015). Likewise, care coordination and discharge planning for patients with higher risk factors related to developing infections may also be important considerations.

Conclusion

Often problems such as surgical site infections are identified, and solutions such as the SSI prevention bundle are created. Although a solution was presented, a sustained decrease in the number of SSIs has not been seen. The framework for sustainability and assessment of barriers to outcomes has not been properly identified. Utilizing the Nursing Role Effectiveness Model may help provide a framework to identify barriers to the sustainability of the bundle.

There are many aspects of the structure in the nursing unit and unit operating rooms necessary to breakdown and consider to ensure the SSI bundle is implemented to the fullest

extent. Additionally, nursing practices and knowledge should also be considered and remedied as this may affect SSI rates as well. Assessing team coordination and communication may also cause a breakdown in the care of the obstetric patients and could be further evaluated for efficiency. Providing SSI baseline rates pre-implementation in comparison to current rates should be evaluated and considered. Assessing ideal practices compared to actual practice may help provide insight on the unit process. Lastly, utilizing the framework provided by the NREM will help identify components of variation and then outcomes can be measured.

Chapter Four: Clinical Protocol

On a Labor and Delivery Unit at an institution in mid-Michigan, C-section surgical site SSI rates in 2015 were 2.68 per 100 surgeries. A SSI prevention bundle was implemented in 2016 and the rates of SSI in 2016 were decreased to 1.76 per 100 surgeries. In the first quarter of 2017, the rates have increased 2.73 per 100 surgeries. The OB/GYN department established a goal to be 1.07 based on NHSN 50th percentile data (Edwards et al., 2009). Although the SSI bundle has been implemented, routinely not all of the aspects of the bundle are completed as identified through chart audits. In the chart audits pre-operative and intra-operative skin preparation, vaginal preparation, hair removal, gel removal, and timely administration of antibiotics have been noted as incomplete. SSIs are costly and cause readmissions or prolonged stay for patients. The purpose of this chapter is to describe the process improvement plan utilizing the Plan-Do-Study-Act (PDSA) cycle by W. Edwards Deming (The W. Edwards Deming Institute, 2016).

Purpose of the Project

The overall purpose of the project is to reduce surgical site infection rates in patients undergoing scheduled cesarean sections. The importance of reducing infection rates is pertinent in improving patient outcomes. Initially, there is a need to determine if there is a gap in the SSI bundle. For this, it was necessary to develop a tool to assist in the gap analysis of the surgical site infection bundle and current practices. Performing a gap analysis will provide measurement of variation in practices. To perform the gap analysis, a retrospective chart audit to gather data on current practice compared to expected practice based on components of the SSI bundle is necessary (See Appendix C). Further considerations such as scheduled versus unscheduled surgeries were analyzed to observe patterns as well. The gap analysis did not show clear patterns

to variation of the bundle. However, the analysis did identify frequently missed components of the bundle (see Appendix H).

Next, expanding the analysis and looking at patterns from the known infections may also prove pertinent. Similar to the gap analysis, assessing patterns may enlighten areas of the process which could use more focus. Lastly, real time chart audits allow communication and collaboration with caregivers who are caring for the patient may help identify barriers to achieving optimal outcomes.

After performing chart audits and a gap analysis, it will be pertinent to share data and information with the unit caregivers and key stakeholders. Providing data related to current practices and C-section infection rates will likely heighten the awareness and strengthen the importance of bundle compliance (see Appendix F and G). Additionally, collaborating with unit based council members, department managers, educator, Clinical Nurse Specialist (CNS), informatics nurse, and key physicians to develop a peer review will be necessary. Peer review may help increase awareness of the bundle and enlist and engage key caregivers on ensuring the bundle is completed correctly.

The gap analysis will provide common themes of areas to improve upon. Formulating a team to determine buy-in and help prioritize focus utilizing the areas of most need identified in the analysis will lay the groundwork for change. The team will be useful because they can help process map and identify barriers in the process and help bring forth ideas to make change.

Needed Resources

Many projects require additional resources and may initially cost money to implement change. No additional supplies have been noted or deemed necessary currently as part of the proposed clinical protocol. Resources to take into consideration is meeting time for staff who are

key for identifying and assisting in promoting bundle compliance. To assist in continued cost awareness, using established meeting times with current teams and requesting time on the agenda will be one tactic to continue cost savings. Other resources may be necessary once the key themes are identified in the gap analysis.

Measurement of Bundle

To help understand C-section infection rates several important pieces of information are necessary for the analysis. Interviews and meetings with unit staff, leaders, physicians, and performance improvement (PI) specialists are necessary to collate information regarding current data and goals for improvement. Observations of the current practices in the operating room (OR) has occurred for scheduled cesarean sections and observed surgeries have not yielded any areas for improvement.

Documentation has been a key tool in assessing bundle compliance. Several important pieces were necessary in order to perform accurate chart audits. First, the written protocol for the C-section SSI bundle was obtained. A tool was also created to assess monthly documentation on recent C-sections (See Appendix D). A Pareto chart will be created as a measurement tool to show bundle documentation compliance. Next, collaboration with the Infection Prevention Department has provided patient information and some pertinent information for patient who had a SSI in 2015, 2016, and the beginning of 2017.

Additional tools that will be useful moving forward will be providing staff with timely reports of monthly infection rates. Team collaboration has been initiated to work with physicians to improve reporting for patients whom they see in their office with an SSI. One barrier to this project has been identified as accurate SSI data collection. Current practice is for data abstractors to pull patient diagnosis codes, but this excludes many of the patients seen in offices

without electronic health records (EHR) that coincide with the local hospital. The current SSI team has collaborated and worked with office managers in the OB/GYN offices' physicians perform surgery at this hospital. The team worked to appoint one person within the outlying offices who's EHR does not collaborate with the hospitals. It was determined physicians will report to this point person and then the data is collected and reported back monthly to the hospitals OB/GYN team and data analyzers.

Utilizing the data from the gap analysis provided trends to identify areas for improvement (see Appendix H). Another tool utilized was having staff assist in a process mapping (see Appendix J) and a fish bone diagram to determine priority focus for their team and identify current processes (see Appendix I). By displaying data in Pareto charts, communicating and collaborating about the current state of SSI bundle and trends has initiated buy-in and raised awareness and has allowed an implementation plan to be developed.

Quality Improvement Process

Utilizing the Plan-Do-Study-Act (PDSA) cycle to help implement practice improvements will be a key step in ensuring and measuring changes as they occur. The first step of the cycle is planning. To being the change project, formulating a team of key stakeholders has been initiated but may need to be expanded. The key stakeholders on this team includes the Clinical Nurse Specialist (CNS) from Women's Services and the CNS from Surgical Services, an OB/GYN physician, Performance Improvement (PI) specialist, information technology (IT), infection prevention, a bedside nurse, and the Clinical Nurse Leader (CNL) student. A surgical site infection team has identified the problem and established a target goal. The problem of C-section SSI has many variables and the gap analysis will help establish initial areas for

improvement to be measured. Furthermore, taking this information to the unit and utilizing feedback from additional frontline caregivers will be necessary.

The ultimate goal is to reduce C-section SSI and this is a measurable outcome. To help decrease SSI rates in this patient population, the gap analysis will provide key areas of the bundle that may be prioritized depending on level of compliance. Addressing two or three areas of non-compliance based on the analysis of the bundle and working with the team a target goal can be set and monitored through documentation audits monthly and displayed on the unit in a Pareto chart. Additional planning will be needed to initiate expected changes. Collaboration with the unit manager and educator is necessary so the information and expectations can be dispersed in huddles, meetings, email, and posters for the unit staff prior to implementing any changes in practice.

The next phase in the cycle is “do”. To begin implementation, the changes will be rolled out in a pilot study on the unit for several weeks and then reevaluated. To measure the outcome of success, retrospective audits can be performed and be available during the change to provide in the moment feedback and hear concerns. Also, a pre and post questionnaire should be provided to assist in measurement. After the small pilot period, assessing the outcomes and analyzing the data will help identify the effectiveness of the changes. Furthermore, the feedback from the frontline caregivers is necessary to identify process issues and barriers to sustainability. After studying the changes implemented, it is important to address any issues before re-implementing them on the unit. Consistent assessment of the effectiveness and compliance will be necessary to affect change. Furthermore, ensuring staff understand why the changes are important and providing data for the staff to see how they are making a difference will help with

the adoption of best practices and further continue to practice best practices to improve patient outcomes. (See Appendix E)

Conclusion

Implementing a change to improve patient outcomes requires understanding the process of complex issues. Identifying and defining a clear problem is a key step to initiate and develop goals. Furthermore, assessing and planning is required to promote sustainability. Gaining buy-in will be done by establishing a team of key stakeholders to help provide insight in the process and barriers to achieving optimal outcomes. Utilizing the PDSA cycle will help keep the change project on track and using measurable outcomes is necessary to monitor success.

Chapter 5: Cesarean Section Surgical Site Infection Prevention Evidence-Based Practices and Implementation Plan

Surgical site infections in C-section patients remains a prevalent problem at a mid-Michigan hospital. Although the problem of SSI in this patient population had previously been identified as a problem, decreased rates have not steadily been observed. The purpose of this chapter is to discuss implementation recommendations and the progress and current state of the project.

Implementation Process

Implementing changes on the Labor and Delivery (L & D) unit requires a lot of planning and deeper understanding. An interprofessional team was initiated and continues to meet to discuss aspects of care which do not meet standards or evidence-based practices (EBP). Through observations, gap analysis, staff brainstorming, fishbone diagraming, and reviews of current data, the SSI team has noticed gaps in obtaining data for C-section SSIs, discharge instructions, terminal cleaning, proper surgical attire, and the SSI bundle.

Data Collection

Data is currently collected with coding within the electronic health record (EHR), but there are limitations with this collection technique. The biggest limitation for utilizing the EHR is several OB/GYN offices do not have an EHR integrated with the hospital's EHR. Often, patients are seen and treated in their OB/GYN physician's office. To help improve data collection, the SSI team included one of the large outlying clinic's manager and physicians to provide them with instructions on properly reporting SSIs. The intention is to share the standardized collection process with other offices not connected by EHR to the hospital.

Proper Discharge Instructions

The C-section bundle was implemented in 2016 and updated discharge instructions were initiated. However, the interprofessional SSI team is constantly evaluating current practices and evidence. Furthermore, the home wound care instructions are included with a large amount of information at discharge. Some literature discussed patient education and providing focused education for wound care and signs and symptoms of infection. Assessing the current state of the discharge instructions with a gap analysis could help assess physician utilization, nursing education provided, and patient understanding.

Terminal Cleaning

Concerns raised by staff have been related to terminal cleaning of the L & D ORs. To further investigate the techniques necessary, the CNL student collaborated with the surgery CNS who serves the main OR. The CNS provided detailed resources related to terminal cleaning. Terminal cleaning should occur in each OR every night and a detailed checklist is to be completed and signed to validate completion.

The CNL student utilized observation and collaboration to assess the current process of terminal cleaning in the L & D OR. To do this, informal conversations with the environmental services (EVS) staff were conducted to help identify the process. Furthermore, the CNL student and the Women's Services CNS attempted to locate the terminal cleaning checklist without success. The CNL student then connected with several EVS supervisors to aid in the search for the terminal cleaning checklist. Once the checklist was located, it was noted from the end of April through mid-June, terminal cleaning were documented 60% of the time, furthermore, the documentation did not seem to be accurate. The documentation of terminal cleaning did not appear accurate based on the nature of the checklist. The checklist has areas to allow for two

weeks of documentation, however, the first and second week areas were being documented on simultaneously. The concern of proper cleanliness was brought forward to the OB/GYN Quality Improvement (QI) committee, and further communication were pursued with the Director of EVS. The director responded and the OB/GYN QI team recommends follow-up in one month to reassess the current state of the checklist, and further observations may be necessary. Furthermore, the Director of Women's and Children's Services has been notified of the concern and plans to collaborate with the EVS director.

Proper Surgical Attire

Another observed gap in the care of the obstetric patients has been adherence to the guidelines provided by the Association of Perioperative Registered Nurses (AORN). There are several major components to follow when caregivers enter the sub-sterile and sterile areas (AORN, 2017).

- Clean surgical attire that is hospital laundered or disposable jumpsuits, head, hair, ear, and facial hair covering
- Clean shoes that are dedicated for use within the perioperative area or shoe covers must be worn
- All non-scrubbed personnel should completely cover their arms with a long-sleeved scrub top or jacket and it should be snapped closed or buttoned up the front

The CNL student and other members of the care team have observed non-compliance to the AORN recommendations. The CNL student has collaborated with the interim manager, current appointed manager, CNS, and the Director of Women's and Children's services with the recommendation it is shared at the hospital-wide safety meeting due to many parties within the

system not complying with expected surgical practices. The CNL student also shared this finding during the daily board report.

Surgical Site Infection Prevention Bundle

The SSI bundle was the main focus for the CNL student. At this time, interventions to the bundle have not been made. The CNL student has provided data on the unit board related to SSI rates to disseminate the information. The student gathered a group of engaged caregivers to present the gap analysis, gather feedback, gain buy-in, and develop a plan. The caregivers requested additional education for documentation prior to creating any interventions.

In August there is a planned "scrub-o-rama" where nurses and physicians will be required to demonstate proper technique for scrubbing a patient. The CNL student helped create videos and electronic versions of the checklist to validate competency. Lastly, assessment the current state of the EHR will be conducted to see if changes could be made to reflect when emergent cases occur, and a variation in practice may be acceptable due to the risk to the health of the mother and baby. The CNL student has been informed in the case of an emergency patients are splashed with betadine instead of the chlorhexidine scrub. The nurse educator has identified new best practices for emergent case skin preparation and this will be implemented during "scrub-o-rama".

Recommendations

There are several recommendations for continued work to help decrease the SSI rates in C-section patients. First, a recommendation to assess how to ensure the data collection process efficiency in the clinic without an integrated EHR. If the collection process is working, it would be ideal to integrate a similar process at other clinics where information does not automate into the hospital's EHR.

Next, a recommendation to assess the wound care discharge instructions and possibly revise to make them separate documents. This would make instructions very identifiable for the mother to see and refer to in the overwhelming amount of information received upon discharge. Also, an implementation recommendation would be to do further literature reviews on cleansing products and then perform a cost analysis to determine the cost-benefit of providing a patient with any additional supplies.

A recommendation for continual reinforcement and observations for following OR standards of care is also suggested. Once significant education is provided further recommendations for the SSI bundle would be to formulate an engaged team of caregivers whom carry out the bundle and have them help identify one or two components of the bundle for focus and improve documentation.

Further recommendations of care be made based on literature reviews. As discussed in Chapter Two, one of the major risk factors identified in these bodies of literature is obesity. Obesity increases postoperative complication by as much as 20 % (Hickson, Harris, & Brett, 2015). Other risk factors include age, diabetes, smoking, immunosuppressive medications, and changes to the operative plan is necessary (Anderson et al., 2014). Interventions and specific care plans could be made for patients with identifiable risk factors.

Successes and Difficulties

Most projects have their gains and losses and this project is not exempt from these. A major success of this project has been greater analysis of the current practices on the L & D unit. Another success was raising awareness and discussing the SSI rates and presenting staff with data. Continuing to assess current practices and literature with the interdisciplinary team has been a win-win. Additionally, an electronic report had been requested previously and has made

substantial gains since the beginning of the project. Finally, a success of this project has been coming in as a student and formulating relationship, understanding the process of the unit, and learning about an integral area of the hospital and witnessing staff engagement and teamwork.

Barriers

There have been several barriers to implementing changes for this project. First, the focus of the project was determined without a proper assessment by the CNL student, including unit stakeholders. Other difficulties of the project have been gathering a formal group of caregivers.

Another difficulty has been a vast change in the department's leadership thus affecting the unit's structure. There seem to be many overshadowing priorities which are competing for time and attention of this project. Choosing a project which the staff feels passionate about may have moved the progress more quickly, but perseverance and continual work at the SSI bundle will likely make improvements to patient outcomes. Finally, a large barrier was time. Being a novice and a student takes more time and having erratic hours on the unit has also been a large barrier to success.

Changes and Sustainability of Current Practices

Many of the implementation practices are in their infancy and will need further evaluation as part of the Plan-Do-Study-Act (PDSA) cycle. The interventions for terminal cleaning, proper surgical attire, and the SSI bundle implementations and recommendations will need to be routinely monitored with non-compliant behaviors addressed to help coach team members. A CNL would be integral in helping sustain the desired behaviors with the opportunity coach in the moment. Collaboration with the unit manager, assistant managers, engaged team members, and CNS will be necessary for sustainability. The interprofessional SSI team will need

to make monitoring these gaps an item on their routine agenda. Once practices are routinely being followed correctly the item may be moved to quarterly review to continue assessing and in order to ensure best practices.

Strengths and Weaknesses of the Project

Having a highly engaged and interprofessional team on the labor and delivery unit is one of the strengths this project has. Best practices are consistently reviewed and discussed among team members. Also having a team where the nurses, residents, physicians, and leadership work so closely together is a positive attribute to the project.

Weaknesses of the project have been finding the exact root of the problem. The CNL student has identified gaps in the care delivery whereby the SSI bundle is not routinely being followed, cleaning is not done properly, and compliance to surgical attire is not occurring. Currently a team member should help enforce such practices. There have been several changes in leadership, insufficient staffing, and many other projects taking precedence.

Evaluating Outcomes

The ultimate outcome of this project is to reduce surgical site infection rates for patients undergoing scheduled cesarean sections. The baseline data for the rates of SSI in 2015 was 2.68 per 100 surgeries. A surgical site infection prevention bundle was implemented on the L & D unit in 2016, and rates of SSI in C-section patients decreased to 1.76 per 100 surgeries for the entire year. The rate of SSIs reported from January through May 2017 reveals a rate of 2.73 per 100 surgeries. However, evaluation of data from outlying clinics will need to be assessed to see if there has been an increase in reporting. Furthermore, no interventions have been made in 2017. Monthly assessment of SSI will need to continue to be evaluated and discussed with the

caregiver and stakeholders on the unit. Feedback should be provided to those involved in the care of patients who have been treated for an infection.

Another outcome to be measure can be discharge instructions through monitoring scores for care transitions on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. This is a lag measure and not fully encompass the specific instructions for C-sections, but may provide some insight if there is a change in score.

Monitoring terminal cleaning can be done by assessing the checklist documentation the EVS caregivers are expected to perform and initial. Weekly monitoring of the checklist should be measured and tracked to monitor the outcomes in order to ensure the OR is cleaned to standard. Collaboration with EVS supervisors may be necessary to assess performance and compliance.

Surgical attire compliance may be a difficult outcome to measure. The AORN guideline (2017) provides evidence supporting the reduction of SSI with compliance to their recommendations. Thus, unannounced observation and peer review to assess compliance will be necessary.

Lastly, the key components of the SSI bundle need to be monitored for compliance. Key components of the bundle include pre-operative antibiotics, chlorhexidine wash, hair clipping, intra-operative vaginal preparation, proper removal of ultrasonic gel, skin preparation, and allowing the skin to dry for three minutes before draping the patient for surgery. Measurement of the key components can be done through random chart audits until the requested report has been properly built with the assistance of the Information Technology (IT) department.

Implications for Practice Discussion about other EBP and Trends

Implications for discussion surrounding current practices for cesarean sections has led to discussions to continuing the plans to expand the SSI bundle as it had been intended with a separate closing tray, but financial implications have been presented and are being discussed. Another implication for discussion of this project has raised awareness about the current practices and need for continual improvement. Furthermore, including C-sections in an Enhanced Recovery Program (ERP) that has been implemented in this hospital for colorectal patients and hysterectomies is being discussed.

Project Limitations

There are several project limitations. The first is accurate data collection so an accurate number of SSIs can be reported. Secondly, a complete report without the necessity of lengthy chart audits would be a limitation to this project. Additionally, capturing emergent situations and the appropriate interventions performed would be ideal as well. Lastly, a limitation to the project is time due to the CNL student involved is only present on the unit two days a week and is constantly learning the structure and process of the department thus making change difficult.

Reflections of the CNL Essentials

The CNL Essentials as provided by the American Association of Colleges of Nursing (2013) provides CNL students with competencies to strive to achieve and understand while implementing and understanding changes at the bedside. There are nine competencies to strive to understand. During this project, the CNL student was able to enact aspects of all competencies.

The CNL student routinely utilized the Essential 1: Background for Practice from Sciences and Humanities by interpreting data to assess the needs of the microsystem in

comparison with benchmark data as a goal to achieve. A variety of communication techniques were utilized in the project mostly through verbal communication and utilization of data presentation on the unit board. Understanding risk factors and barriers to patient care helped to incorporate social determinants and address potential gaps in care. Utilizing the Nursing Role Effectiveness model addressed improvement science and nursing theory.

Essential two is related to organizational and systems leadership and was enacted through understanding the healthcare system and health delivery system. It was also enacted with professional relationships. Performing a microsystem assessment, collaborating with the department manager and understanding budgets were also done. Doing a gap analysis of the current state of the SSI bundle as well as recommended OR guidelines identified in the literature helped this author identify efficacy and utilization of evidence-based practices.

Essential three is about quality improvement and safety. This essential was utilized throughout the project. The microsystem assessment, assessment of current practices, literature review, professional communication with staff, data dissemination, and interprofessional collaboration was done with the intention of promoting quality improvement.

Essential four is about translating and integrating scholarship into practice. This essential was enacted by collaborating professionally with interdisciplinary teams and fostering positive relationships to promote EBP and encourage growth and engagement. Presenting at the Unit Based Council meetings about changes that were occurring and disseminating current SSI data as well as encouraging people to discuss the barriers or questions surrounding the care of their patients while helping provide and steer them into understanding and following EBP is all wrapped into this essential.

Essential five integrates informatics and health care technology. To help understand this essential this author asked many questions about data and utilized resources to understand reports. Also, this author was involved in requesting a new IT report and has worked with an informatics nurse working with the L & D team. This author was a part of a team who identified confusion with EHR documentation which was changed and has performed audits to understand processes in the EHR. Collaboration with the Performance Improvement team has led to data tracking and dissemination of the current SSI rates.

The next essential, essential six is related to health policy and advocacy. This essential was enacted by understanding the purpose and necessity of a standardized practice and asking a lot of questions related to how governing and regulatory bodies affect reimbursement. Collaboration with the interdisciplinary team members has helped formulate relationships with the CNS, educator, and CNL student. Discussions about role clarity and which aspects of care the CNL would enact were discussed.

Essential seven involves interprofessional collaboration and improvement for population health outcomes. This essential was enacted through working with many different teams. Working with the resident physicians in a role playing event, collaborating EBP with physicians, nursing staff, leaders, educators, and surgical techs to explain the role of a CNL and formulating relationships and listening to concerns with attempts to follow through to make them heard. Demonstrating an understanding of this project and providing evidence supporting aspects of care helped the CNL student fulfill this essential.

Essential eight is clinical prevention and population health for improving health. In this project, risk factors for patients were identified and discussed. The CNL student listened during high-risk care planning for patients and collaborated whenever applicable. The CNL student was

able to discuss with an obese and hypertensive patient, the implications of obesity and risk factor for accruing an SSI. Utilizing teach back methodology demonstrated the patient understood.

Finally, essential nine is the mater's level nursing practice essential which integrates much of the learned behaviors into practice. Many aspects of this essential were demonstrated in previous essentials. Professional and interdisciplinary communication while promoting patient safety and EBP was the basis for this project. Advocating for quality patient care and tracking progress through data was done with SSI data.

Conclusion

Overall, the SSI project has been challenging and slow moving. There have been strengths and weaknesses, but constant communication with staff has enlightened some of the areas of greatest need for preventing SSI. Proper adherence to desired OR behaviors has been a challenge and getting an engaged group of individuals who are at the bedside together has not occurred, but will likely prove to be integral in rapid cycle changes and improvement for SSI prevention in C-sections.

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infection after major gynecologic cancer surgery. *Obstetrics & Gynecology*, 127(6), 1135-1144. doi:10.1097/AOG.0000000000001449

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Appendix A

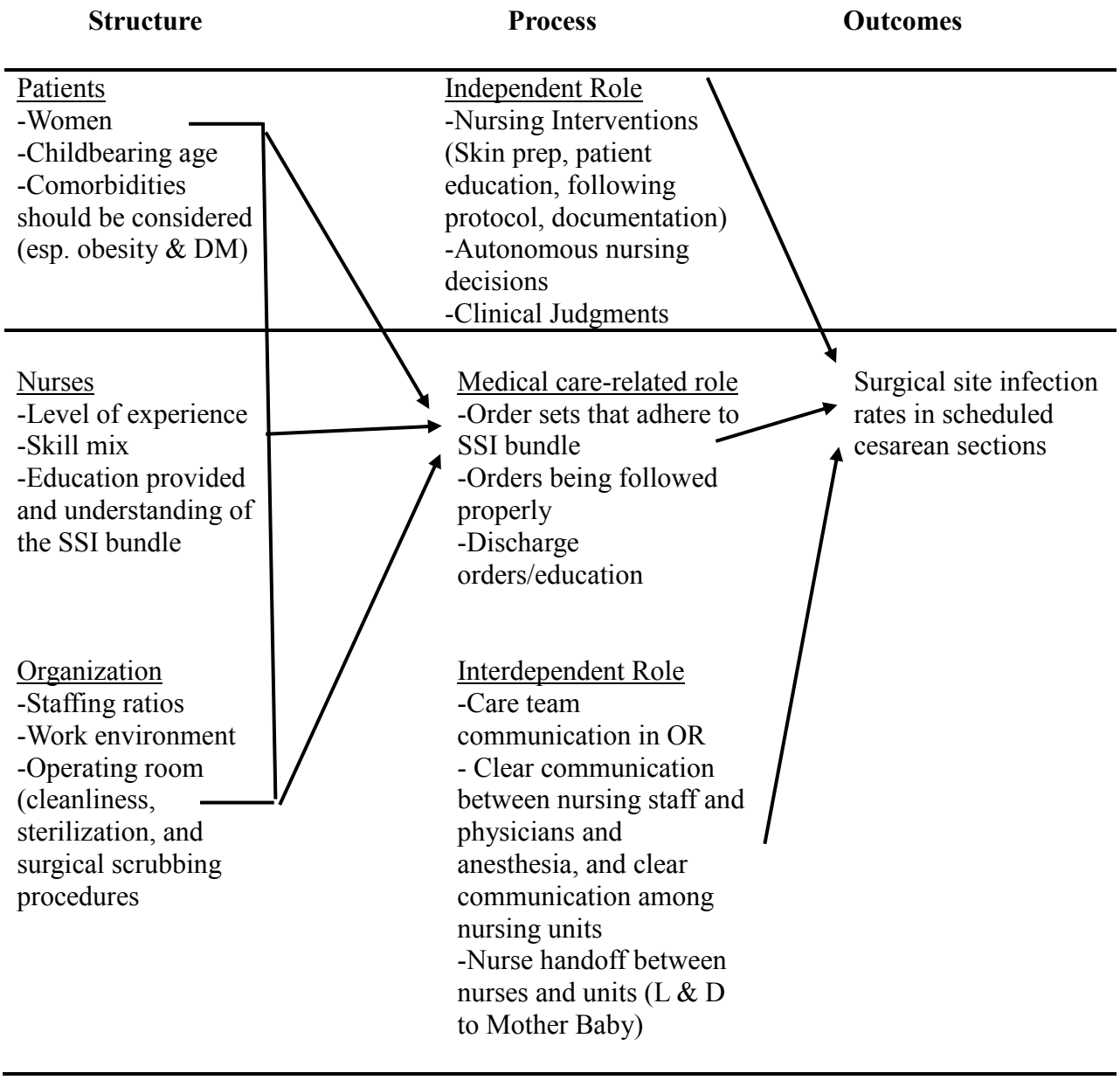
Citation	Article Name	Study Purpose/Aim	Design/Method	Sample/Setting	Measurement	Data Analysis/Results	Level of Evidence	Intervention	Strengths	Weaknesses	Theme	Comments
Allegranzi, B., Zayed, B., Bischoff, P., Kubilay, N. Z., de Jonge, S., de Vries, F., . . . Solomkin, J. S. (2016). New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: An evidence-based global perspective. The Lancet Infectious Diseases, 16(12), e276-e287. doi:10.1016/S1473-3099(16)30398-X	Surgical site infections 1: New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective	Develop evidence based and expert consensus-based recommendations for prevention of SSI globally.	Systematic literature reviews of high level research (RCTs , meta-analysis, etc.)	Systematic literature reviews	Systematic literature reviews and analysis of the level of evidence	12 recommendations questioned for preventions of SSI. 7 of the 12 questions have been strongly recommended. 4- decolonization with mupirocin ointment with or without CHG body wash in nasal carriers of Staphylococcus aureus undergoing cardiothoracic and orthopedic surgery, 7-MBP without the use of oral antibiotics, 8-Hair removal, 9-Optimal timing for administration of SAP, 10-Precise timing for administration of SAP, 11- surgical hand preparation, 12-Surgical site preparation	Level 1	Recommendations for standards of perioperative surgical care	Collaboration of numerous studies and expert opinion based on systematic reviews of high level research, discussed methodology and levels of evidence evaluated, also discussed criteria, and included multiple language, and was intended for global use	Did not discuss each RCT strength/weakness, and numerous studies were not high quality evidence	Perioperative recommendations	Assesses/analyzes cost effectiveness in relation to low and middle income countries
Allegranzi, B., Zayed, B., Bischoff, P., Kubilay, N. Z., de Jonge, S., de Vries, F., . . . Solomkin, J. S. (2016). New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: An evidence-based global perspective. The Lancet Infectious Diseases, 16(12), e288-e303. doi:10.1016/S1473-3099(16)30402-9	Surgical site infections 2: New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective	Develop evidence based and expert consensus-based recommendations for prevention of SSI globally.	Systematic literature reviews of high level research (RCTs , meta-analysis, etc.)	Systematic literature reviews	Systematic literature reviews and analysis of the level of evidence	16 recommendations for SSI Prevention (not limited to C-sections). 1. Periop O2, 2, Normothermia, 3. Glucose control, 4, Normovolaemia, 5. Disposable drapes & gowns, 6. Adhesive incise drapes, 7. Wound-protector devices, 8. Incisional wound irrigation with providone-iodine solution, 9. Incisional wound irrigation with abx, 10. Prophylactic negative pressure wound therapy, 11, Antimicrobial coated sutures, 12, Laminar airflow ventilation systems in OR, 13, Antimicrobial prophylaxis in the presence of a drain, 14. Optimal timing for wound drain removal, 15. Wound dressings, 16. Surgical antibiotic prophylaxis prolongation. Overall, number 1 & 16 were given as strong recommendations based on evidence.	Level 1	Recommendations for standards of intra/post-operative surgical care	Collaboration of numerous studies and expert opinion based on systematic reviews of high level research	Many studies utilized were found to be low quality evidence	Analyzing problem associated with standardizing surgical practices to prevent SSIs intra/post-operatively	Assesses/analyzes cost effectiveness in relation to low and middle income countries
Anderson, D. J., Podgorny, K., Berríos-Torres, S. I., Bratzler, D. W., Dellinger, E. P., Greene, L., . . . Kaye, K. S. (2014). Strategies to prevent surgical site infections in acute care hospitals: 2014 update. Infection Control and Hospital Epidemiology, 35 Suppl 2(S2), S66-S88. doi:10.1017/S0899823X00193869	Strategies to Prevent Surgical Site Infections in Acute Care Hospitals : 2014 Update	Provide practical recommendations in a clear format to assist acute care hospitals in implementing and prioritizing their SSI prevention efforts	Utilization of guidelines based from the CDC, HICPAC, NICE, SIP, SCIP, IHI, The Joint Commission National Patient Safety Goals, & Federal requirements (CMS)	Systematic literature reviews	Systematic literature reviews and analysis of the level of evidence-meta-analysis	Current guidelines provided in a clear layout with level of evidence defined	Level 1	1. Antimicrobial prophylaxis, 2. Do not remove hair at the operative site unless the presence of hair will interfere with the operation. Do not use razors, 3. Control blood glucose during the immediate postoperative period, 4. Maintain normothermia during the preoperative period, 5. Optimize tissue oxygenation by administering supplemental oxygen during and immediately following surgical procedures involving mechanical ventilation, 6. Use alcohol-containing preoperative skin preparatory agents if no contraindications exists, 7. Use impervious plastic wound protectors for GI and biliary tract surgery, 8. Use a checklist based on the WHO checklist to ensure compliance with best practices to improve surgical patient safety, 9. Perform surveillance for SSI, 10. Increase the efficiency of surveillance through utilization of automated data, 11. Provide ongoing feedback of SSI rates to surgical and perioperative personnel and leadership, 12. Measure and provide feedback to providers regarding rates of compliance with process measures, 13. Educate surgeons and perioperative personnel about SSI prevention, 14. Educate patients and their families about SSI prevention as appropriate, 15. Implement policies and practices aimed at reducing the risk of SSI that align with evidence-based standards.	Recommendation based on practice guidelines from esteemed agencies and utilized high levels of evidence	The article is sponsored by several agencies	SSI bundle	The article includes rationale, background, interventions (strategies), special approaches, performance measures, & implementation strategies

Gregson, H. (2011). Reducing surgical site infection following caesarean section. Nursing Standard (Royal College of Nursing (Great Britain): 1987), 25(50), 35-40. doi:10.7748/ns.25.50.35.s48	Reducing Surgical Site Infection Following Caesarean Section	The aim was to improve infection rates and monitor compliance of the guidelines set for by the National Institute for Health and Clinical Excellence (NICE).	Controlled Trial	Two Hospitals in England with a sample size of 2,382	All C-section patients at 2 hospitals	Application of NICE guidelines decreased SSIs in C-sections, but use of dressings showed even further decrease.	Level 3	Surgical Dressings in compliance with NICE guidelines with removal at 48 hours post surgery and pre-operative clipping was introduced	Two separate locations able to compare similar intervention. Substantial sample size. Cost analysis provided for specialty dressings.	Data results based on questionnaire results and obtaining accurate post-op data	Dressing removal and pre-op clipping - 2 pieces of SSI bundle	
Henman, K., Gordon, C. L., Gardiner, T., Thorn, J., Spain, B., Davies, J., & Baird, R. (2012). Surgical site infections following caesarean section at Royal Darwin Hospital, Northern Territory. Healthcare infection, 17(2), doi:10.1071/HI11027	Surgical Site Infections Following Caesarean Section at Royal Darwin Hospital, Northern Territory	SSI surveillance and intervention to prevent further infections	Retrospective and Prospective data collection. Controlled Trial	14 month surveillance. Retrospective and Prospective in a hospital in Australia. The hospital studied surveillance on all SSI but also analyzed risk factors for increased rates of SSI. Sample size of 583 for surveillance data and 217 for post interventional	Patients who were diagnosed with SSI during hospitalization and patients with diagnosis of SSI on readmission.	Statistical analysis using fishers exact test was utilized. SSI rates decreased by nearly half	Level 3	Changing skin prep to CHG, changing antibiotics, and staff education	Surveillance for 14 months to determine risk factors,	Excluded non-admitted or readmitted SSIs in data. Data unobtainable on all individuals post surgery,	Implementation of CHG and pre-incisional ABX- 2 aspects of the SSI bundle	
Hickson, E., Harris, J., & Brett, D., (2015). A journey to zero: reduction of post-operative cesarean surgical site infections over a five-year period. Surgical Infections, 18(2), 174-177. doi: 10.1089/sur.2014.145	A Journey to Zero: Reduction of Post-Operative Cesarean Surgical Site Infections over a Five-Year Period	Reduce number of complications and assess clinical, economic, and psychological complications	Systematic chart review perfumed on 4,942 patients after incremental interventions were implemented	Systematic chart review on 4,942 patients at an inner city hospital in Washington State.	Significant reduction of SSI provided by statistical analysis and fishers exact test	Rate of SSI decreased from 2.13 % in 2007 to 0.10% in 2012 (a 95.3% reduction)	Level 3	Hand hygiene and basic infection prevention taught to patients, hair removal performed by clipping rather than shaving, patients asked not to wear makeup or jewelry, Pre-op skin prep changed to CHG, careful removal of drapes, sutures instead of staples, standardized pre and post-op protocols, post-op dressing was changed on day 3 and new high risk dressing and negative wound pressure therapy	Discussed difference between high and low risk patients and modifiable needs. Researchers disclosures were identified.	Unable to identify which intervention show significant reduction in SSI rates.	Updating practices to follow guidelines SSI bundle	
Holland, C., Foster, P., Ulrich, D., & Adkins, K. (2017). A Practice Improvement Project to Reduce Cesarean Surgical Site Infection Rates. Nursing for Women's Health, 20(6), doi: http://dx.doi.org/10.1016/j.nwh.2016.10.006	A Practice Improvement Project to Reduce Cesarean Surgical Site Infection Rates	Reduce and reverse the trend of increasing SSI rates in patients who undergo C-sections by implementing multiple concurrent educational and physical strategies	EBP Improvement model	U.S Midwestern regional hospital	Retrospective chart audits and then prospective data after intervention	Decreased rate of SSI from 1.35% in 2013 to 0.36% in 2015	Level 3	Peri-op instructions, routine phone calls pre-op, review practice guidelines with applicable staff, encourage proper hand washing for all staff, patients and visitors, CHG skin prep, instruct OR personal on abdominal surgical prep, re-educate staff on revised patient education, develop professional post-op wound care video	Literature review exclusion and inclusion criteria were included, PDCA cycle was discussed specifically,	QI study, not research	Continue with current SSI bundle, and improve process	

Hsu, C., Cohn, I., & Caban, R. (2016). Reduction and sustainability of cesarean section surgical site infection: An evidence-based, innovative, and multidisciplinary quality improvement intervention bundle program. American Journal of Infection Control, 44(11), 1315-1320. doi:10.1016/j.ajic.2016.04.217	Reduction and sustainability of cesarean section surgical site infection: An evidence-based, innovative, and multidisciplinary quality improvement intervention bundle program	Reduce SSI rates in C-section patients by implementing infection control policies and a pre-surgical checklist	Retrospective study	3,334 deliverers between 2008 - 2014 at a hospital	Chi-squared, fishers exact test and standard Z test utilized for statistical analysis. All	Chi square test, fishers exact test, and standard Z test were used for statistical analysis. SSI rates for C-sections were 6.2% in phase A, 3.7% in phase B, 1.7% in phase C, and 0.1% in phase D. SSI rates were reduced significantly between each phase	Level 2	A-Baseline data, B- infection control policy implemented (jewelry restriction for staff, appropriate closure of operation room door, prohibition of long sleeves in pediatrician attire at the OR, hand hygiene compliance, placement of alcohol dispensers in patient bathrooms, administration of ABX within 1 hr. of surgery, CHG for skin prep, and multidisciplinary team education), C- IC policies and evidence-based presurgical checklist	IRB approved, EBP interventions implemented and decreased rates sustained	Lack of demographics provided, difficulty in retrieving follow-up data	SSI bundle	Hand hygiene for patients included
Johnson, M. P., Kim, S. J., Langstraat, C. L., Jain, S., Habermann, E. B., Wentink, J. E., . . . Bakkum-Gamez, J. N. (2016). Using bundled interventions to reduce surgical site infection after major gynecologic cancer surgery. Obstetrics & Gynecology, 127(6), 1135-1144. doi:10.1097/AOG.0000000000001449	Using Bundled Interventions to Reduce Surgical Site Infection After Major Gynecologic Cancer Surgery	To investigate whether implementing a bundle, defined as a set of EBP performed collectively, can reduce 30 day surgical site infections	Retrospective data followed by implementation of sterile closing tray etc. prospective data	Mayo Clinic, large academic center	open uterine CA, ovarian CA with bowel resection, and ovarian CA without bowel resection	Substantial reduction in SSI rates in all 3 surgeries Significant	Level 2 & 3	Sterile closing tray, glove change for fascia and skin closure, dressing removal 24-48 hr. post, d/c with 4% CHG, and nurse phone follow-up	Previous similar interventions have been studied and reported effective. Multidisciplinary approach, members with National Surgical Quality Improvement Program, data abstractors blinded to intervention date, sustained decrease in SSI rates occurred	Constraint on sample size due to system regulations, even though a large reduction in SSI was shown, the intervention sample size was not large enough to be statistically significant at 80% power. Also, data was collected for 3 cohorts of patients and patient characteristics varied from pre-intervention and	Adding to the basic bundle	GYN surgery not C-section
Pellegrini, J. E., Toledo, P., Soper, D. E., Bradford, W. C., Cruz, D. A., Levy, B. S., & Lemieux, L. A. (2017). Consensus bundle on prevention of surgical site infections after major gynecologic surgery. Obstetrics & Gynecology, 129(1), 50-61. doi:10.1097/AOG.0000000000001751	Consensus Bundle on Prevention of Surgical Site Infections After Major Gynecologic Surgery	Provide recommendations that can be implemented into any surgical environment in an effort to reduce SSI	Multidisciplinary team organized literature and guideline review	N/A	N/A	See intervention	Level 4	Establish standard preoperative care instructions and education for women undergoing major gynecologic surgery (such as hysterectomy), including postoperative wound care instructions (written and verbal,2. Establish a system that delineates responsibility for every member of the surgical team, 3. Establish standards for temperature regulation, 4. Standardize the selection and timing of administration of prophylactic antibiotics, ideally using order sets or checklist, 5. Standardize the timing of discontinuation of prophylactic antibiotics, ideally using order sets or checklists, 6. Establish standard on appropriate skin preparation, both preoperatively and postoperatively, 7. Assess patient risk preoperatively for surgical site infection, 8. Develop intraoperative “Timeouts” to address antibiotic dosage, timing, prophylaxis issues, and patient-specific issues, 9. Reassess patient risk for surgical site infection based on length of surgery, potential bowel incision, vaginal contamination, and amount of blood loss, 10. Provide postoperative care instructions and education to women undergoing major gynecologic surgery (such as hysterectomy) and family members or other support persons, 11. Establish a culture of huddles for high-risk patient, 12. Create system to analyze and report surgical site infection data, 13. Monitor outcomes and process metrics, 14. Actively collect and share physician-specific surgical site infection data with all surgeons as part of their ongoing professional practice evaluation, 15. Standardize a process to actively monitor and collect surgical site infection data with post discharge follow-up	Expert opinion based on current guidelines	Did not discuss methodology for selection of criteria, did not provide level of evidence or types of evidence utilized,	Readiness (every facility), Recognition and Prevention (every patient), Response (every case), Reporting and Systems Learning (every facility) - SSI bundle	

Appendix B

Nursing Role Effectiveness Model and Surgical Site Infections in Obstetric Patients



Irvine, D., Sidani, S., & Hall, L. M. (1998). Linking outcomes to nurses' roles in health care. *Nursing Economics,* 16(2), 58. Retrieved from http://go.galegroup.com.ezproxy.gvsu.edu/ps/i.do?p=ITOF&u=lom_gvalleysu&id=GALE|A20517707&v=2.1&it=r&sid=summon&authCoun

Appendix C

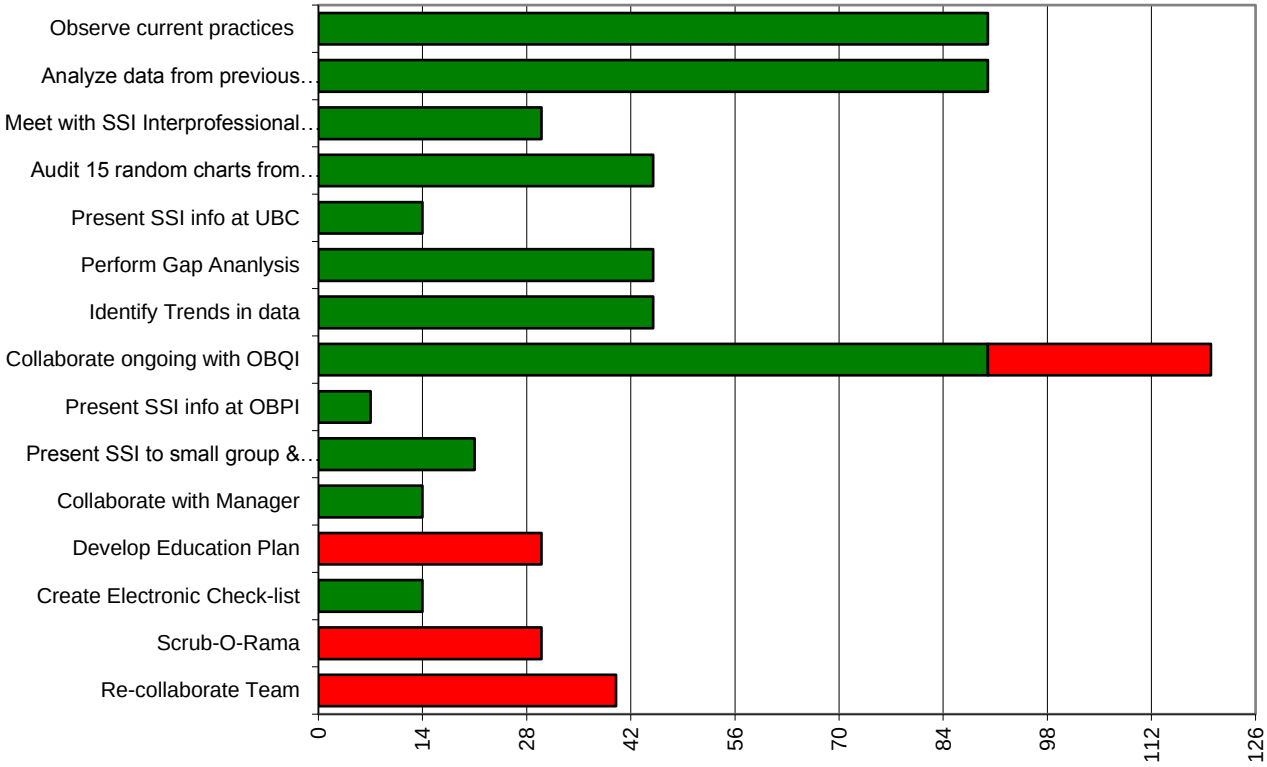
							SSI Audit Tool																
MRN	Patient Name	Scheduled/ unscheduled	CHG/ hibiclens Prep at home	CHG pre-op if not done at home	Hair Removal with clippers	U/S gel removed	Vag Prep	Intra-op Chloroprep skin prep	Skin prep dry (3 min)	ABX Time	Incision time	ABX within 60 min of incision	Wound closure device	Delivery date	BMI (in kg)	Notes	Allergies	Pertinent History (ie. Risk factors)	DM	Blood sugar control	Temp	Inta op	Post op temp

Appendix D

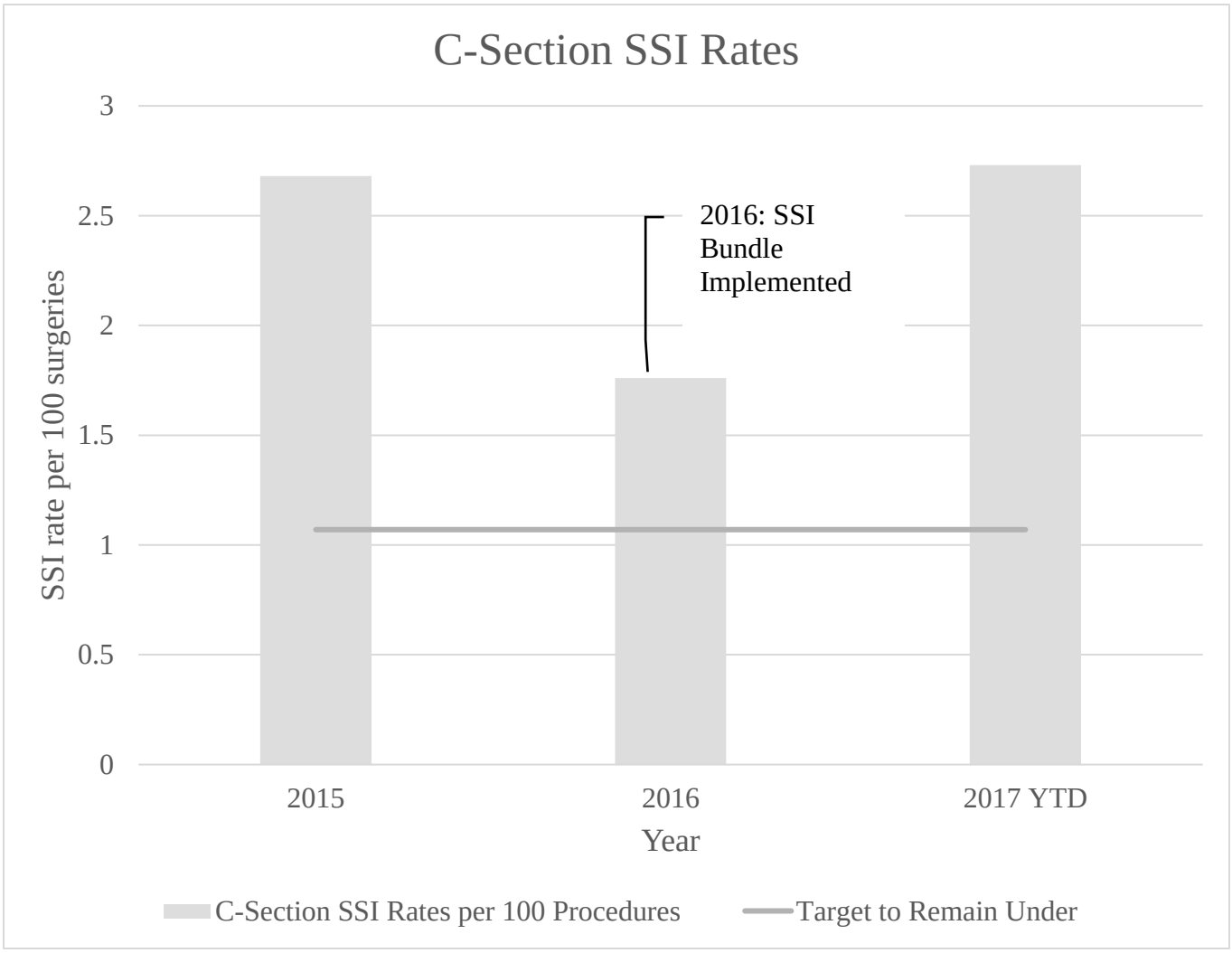
MRN	Patient Name	Scheduled/ unscheduled	CHG/ hibiclens Prep at	CHG pre-op if not done at	Hair Removal with	U/S gel removed	Vag Prep	Intra-op Chloroprep skin	Skin prep dry (3 min)	ABX Time	Incision time	ABX within 60 min of	Delivery date	BMI (in kg)	Notes	Allergies	Pertinent History (ie. Risk

Appendix E

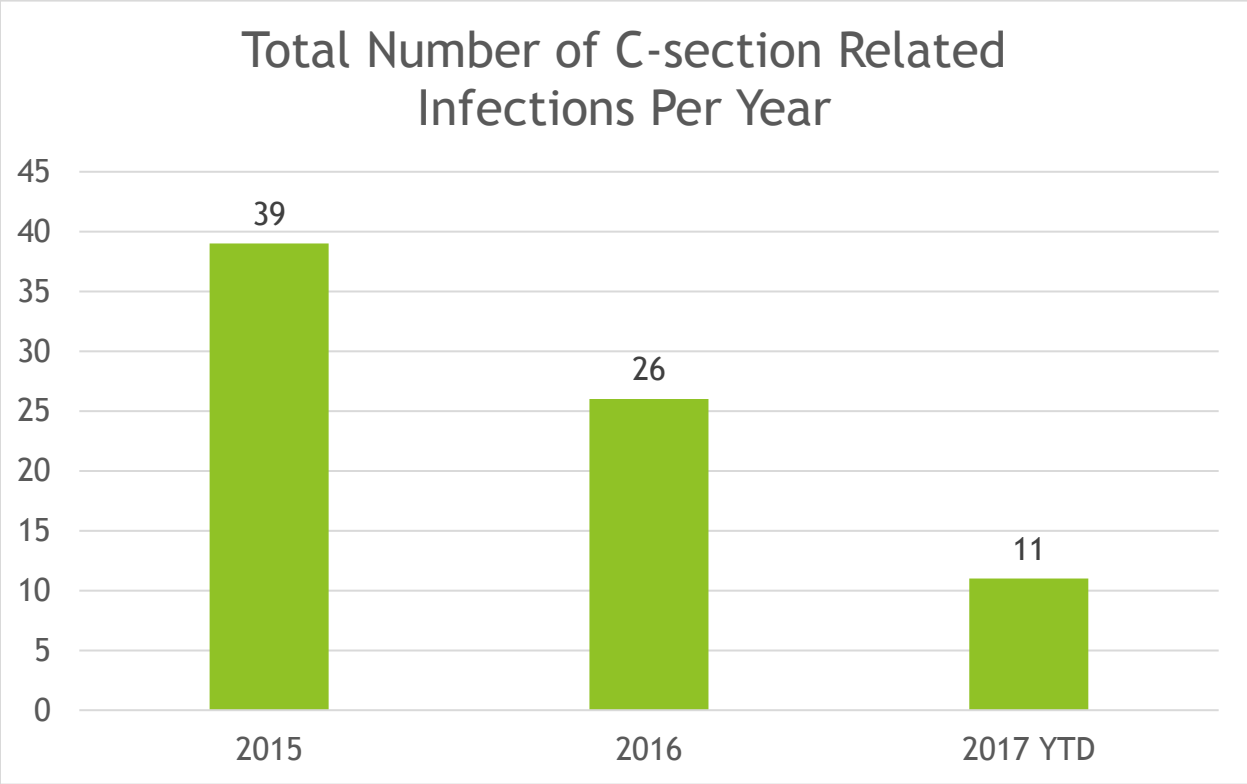
Gantt Chart



Appendix F

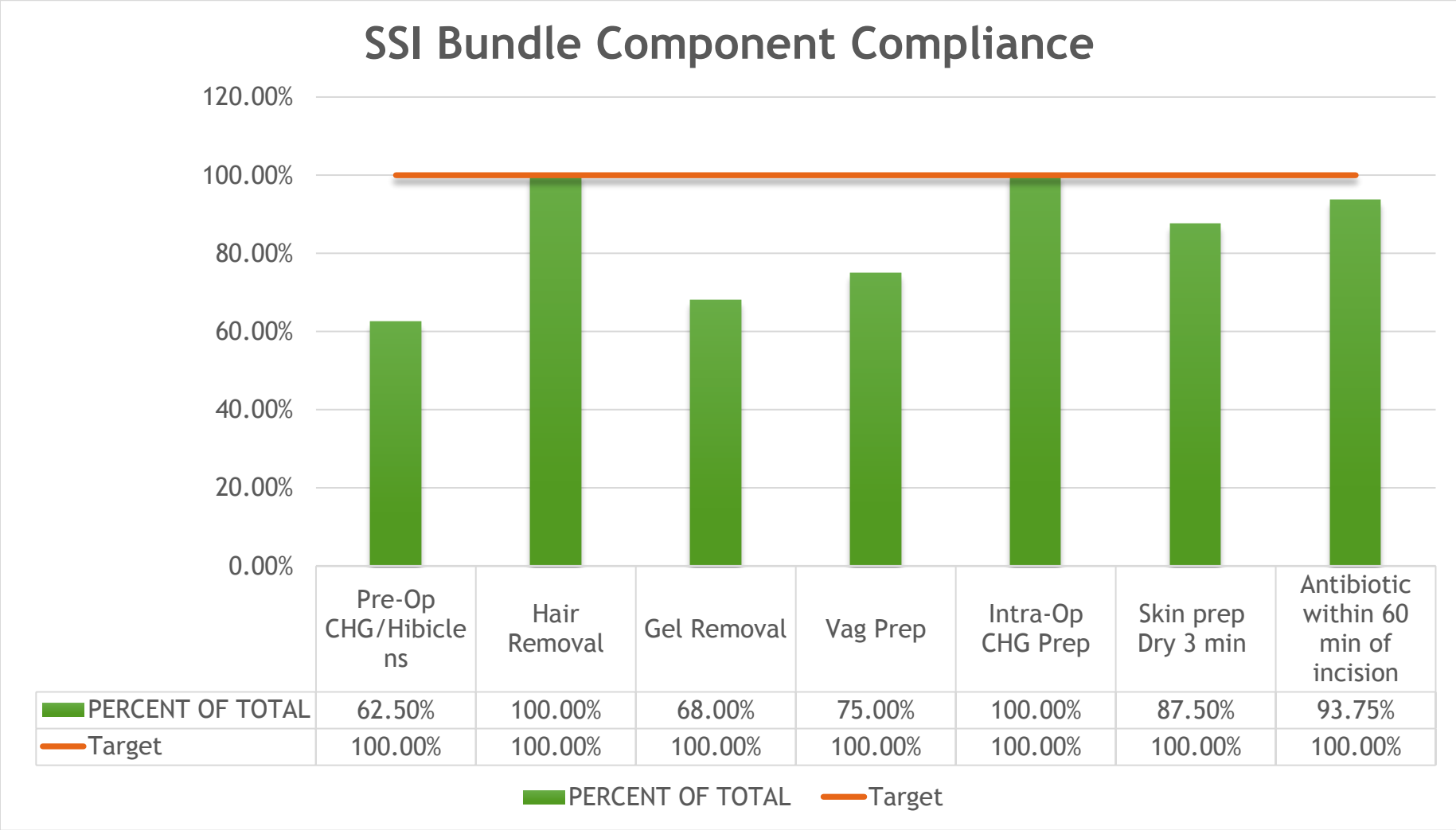

C-Section SSI Rates
3
2.5
2
1.5
1
0.5
0
SSI rate per 100 surgeries
2016: SSI Bundle Implemented
2015
2016
2017 YTD
Year
C-Section SSI Rates per 100 Procedures
Target to Remain Under

Appendix G


Total Number of C-section Related Infections Per Year
45
40
35
30
25
20
15
10
5
0
39
26
11
2015
2016
2017 YTD

Appendix H

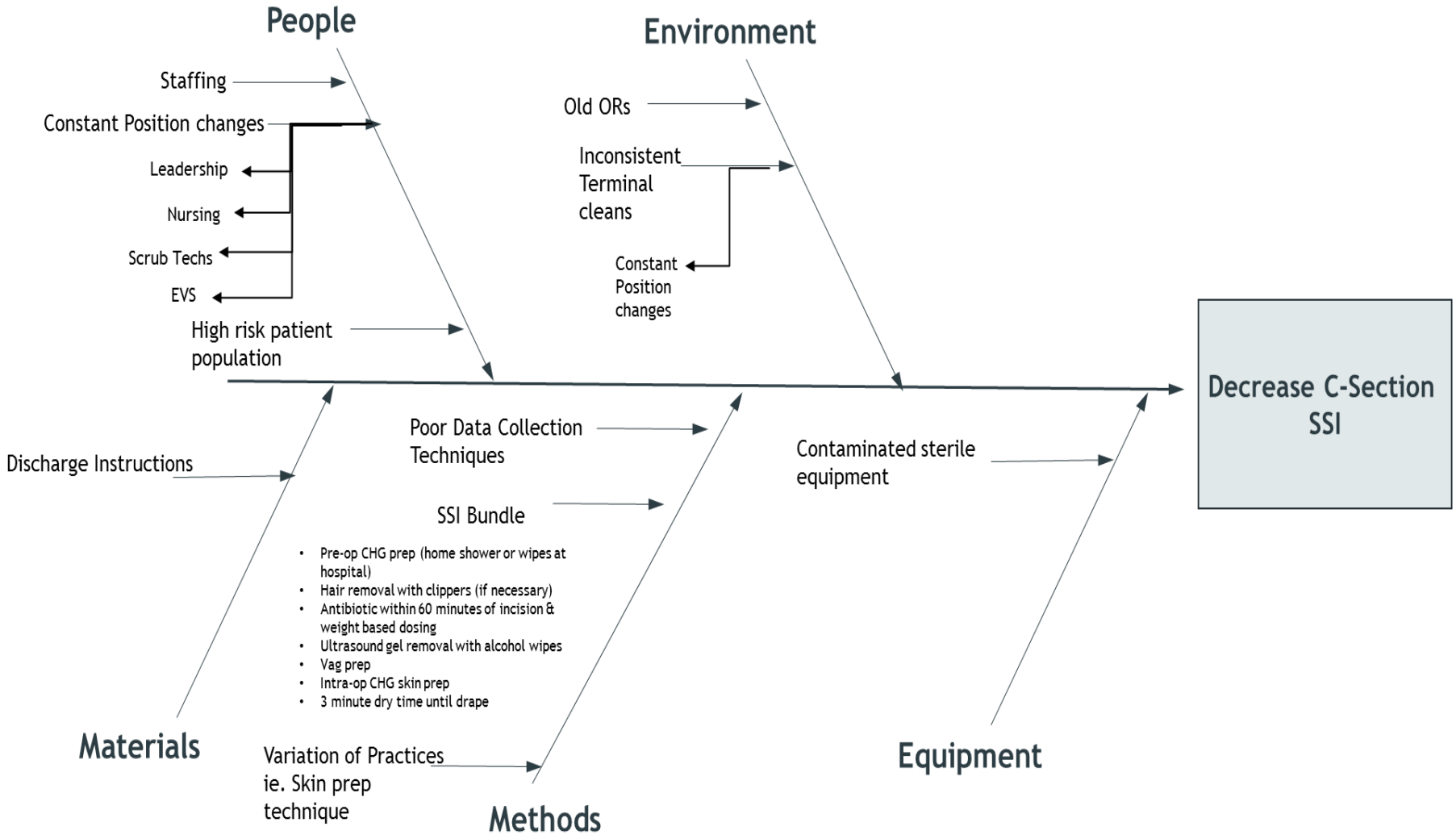
Gap Analysis



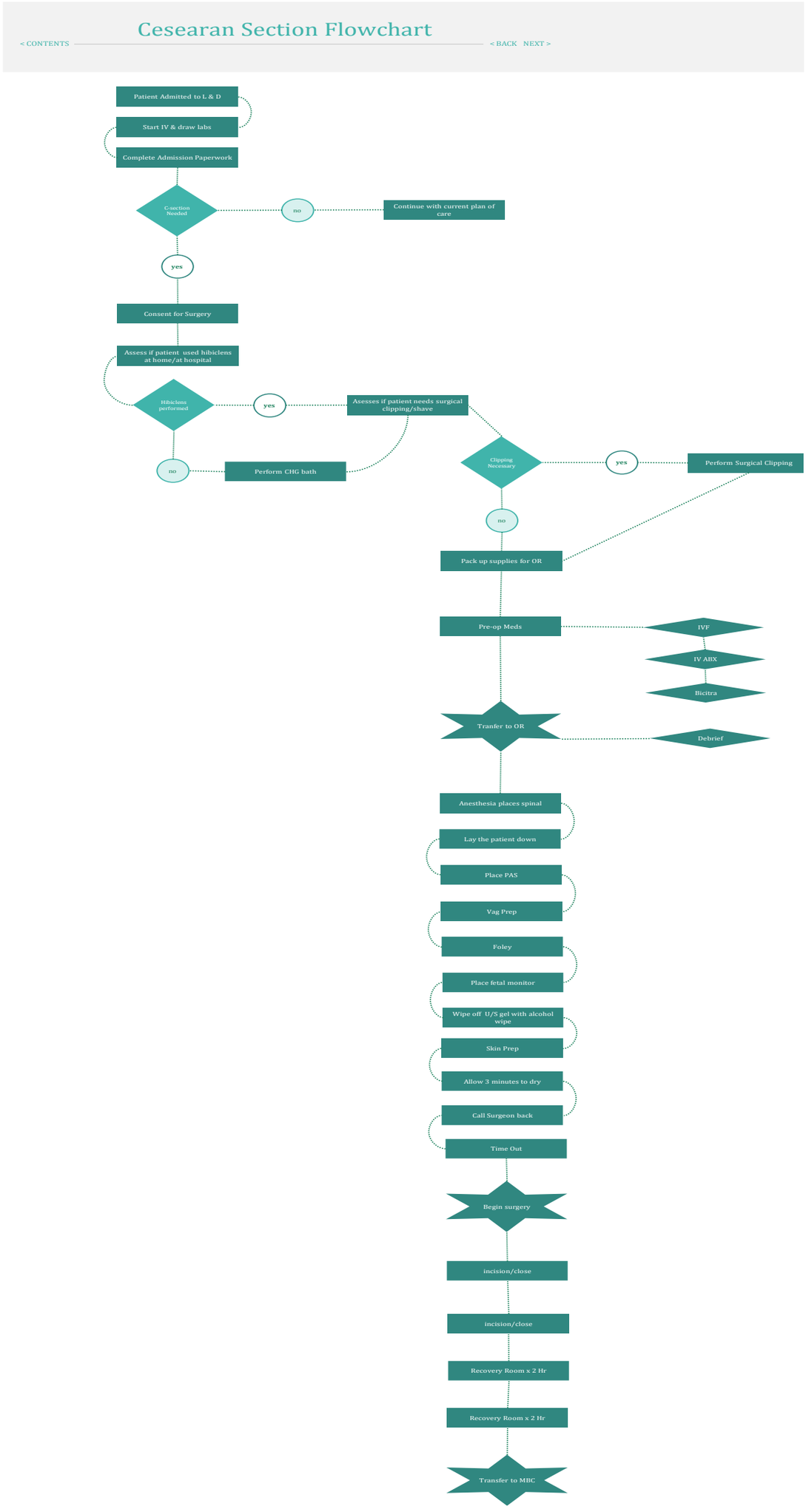
	Pre-Op CHG/Hibiclens	Hair Removal	Gel Removal	Vag Prep	Intra-Op CHG Prep	Skin prep Dry 3 min	Antibiotic within 60 min of incision
PERCENT OF TOTAL	62.50%	100.00%	68.00%	75.00%	100.00%	87.50%	93.75%
Target	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Appendix I

Fishbone Diagram



Appendix J


Cesearan Section Flowchart
< CONTENTS
< BACK NEXT >
Patient Admitted to L & D
Start IV & draw labs
Complete Admission Paperwork
C-section Needed
no
Continue with current plan of care
yes
Consent for Surgery
Assess if patient used hibiclens at home/at hospital
Hibiclens performed
yes
Asesses if patient needs surgical clipping/shave
no
Perform CHG bath
Clipping Necessary
yes
Perform Surgical Clipping
no
Pack up supplies for OR
Pre-op Meds
IVF
IV ABX
Bicitra
Tranfer to OR
Debrief
Anesthesia places spinal
Lay the patient down
Place PAS
Vag Prep
Foley
Place fetal monitor
Wipe off U/S gel with alcohol wipe
Skin Prep
Allow 3 minutes to dry
Call Surgeon back
Time Out
Begin surgery
incision/close
incision/close
Recovery Room x 2 Hr
Recovery Room x 2 Hr
Transfer to MBC