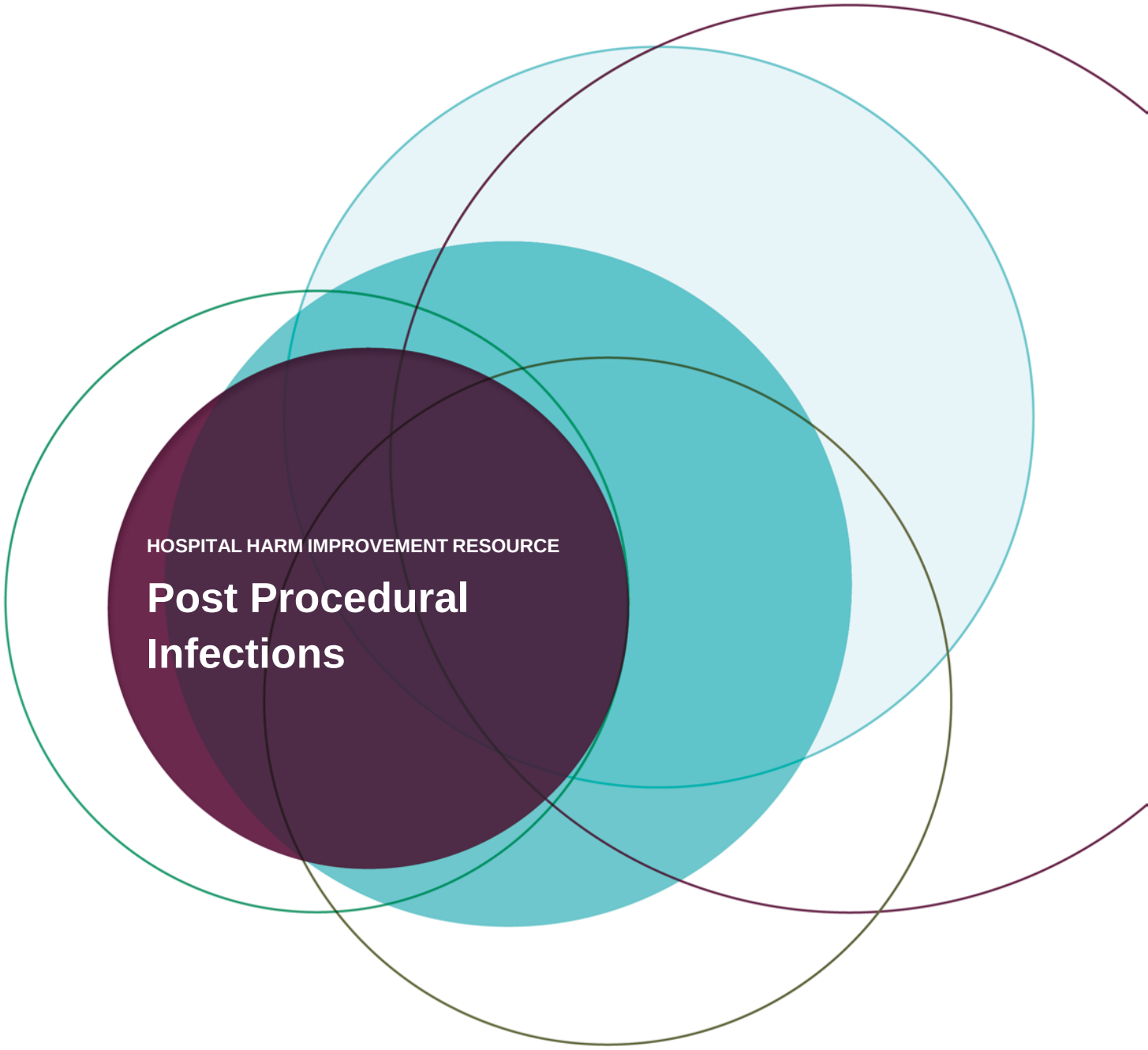

HOSPITAL HARM IMPROVEMENT RESOURCE

Post Procedural Infections

cpsi icsp
Canadian Patient Safety Institute
Institut canadien pour la sécurité des patients

ACKNOWLEDGEMENTS

The Canadian Institute for Health Information and the Canadian Patient Safety Institute have collaborated on a body of work to address gaps in measuring harm and to support patient safety improvement efforts in Canadian hospitals.

The Hospital Harm Improvement Resource was developed by the Canadian Patient Safety Institute to complement the Hospital Harm measure developed by the Canadian Institute for Health Information. It links measurement and improvement by providing evidence-informed resources that will support patient safety improvement efforts.

The Canadian Patient Safety Institute acknowledges and appreciates the key contributions of Dr. Claude Laflamme, MD FRCPC for the review and approval of this Improvement Resource.

DISCHARGE ABSTRACT DATABASE (DAD) CODES INCLUDED IN THIS CLINICAL CATEGORY:

B13: Post Procedural Infections		
Concept	Infections associated with a medical or surgical procedure.	
Notes	1. Post-procedural infections due to methicillin-resistant *Staphylococcus aureus* (MRSA) or vancomycin-resistant enterococci (VRE) can also be included in B18: Infections Due to *Clostridium difficile*, MRSA or VRE. 2. This clinical group excludes post-procedural urinary tract infection, gastroenteritis, pneumonia and aspiration pneumonia (refer to B12: Urinary Tract Infections, B14: Gastroenteritis, B15: Pneumonia and B16: Aspiration Pneumonia). 3. This clinical group may include inflammatory reactions in the absence of infection.	
Selection criteria	O86.002	Identified as diagnosis type (M), (1), (2), (W), (X) or (Y)
	T80.2 T81.4 T82.6 T82.7 T83.6 T84.5– T84.6– T84.7 T85.7 T87.0*1 T87.1*1 T87.201 T87.4–	Identified as diagnosis type (2) **AND** Y60–Y84 **in the same diagnosis cluster**
Exclusions	Events selected from a diagnosis cluster that is also selected for B12: Urinary Tract Infections, B14: Gastroenteritis, B15: Pneumonia and B16: Aspiration Pneumonia	

Codes	Code descriptions
O86.002	Infection of obstetric surgical wound; delivered with mention of postpartum complication
T80.2	Infections following infusion, transfusion and therapeutic injection
T81.4	Infection following a procedure, not elsewhere classified
T82.6	Infection and inflammatory reaction due to cardiac valve prosthesis
T82.7	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts

Codes	Code descriptions
T83.6	Infection and inflammatory reaction due to prosthetic device, implant and graft in genital tract
T84.5–	Infection and inflammatory reaction due to internal joint prosthesis
T84.6–	Infection and inflammatory reaction due to internal fixation device (any site)
T84.7	Infection and inflammatory reaction due to other internal orthopedic prosthetic devices, implants and grafts
T85.7	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts
T87.0*1	Complication of reattached (part of) upper extremity; infection
T87.1*1	Complications of reattached (part of) lower extremity; infection
T87.201	Infection of other reattached body part
T87.4–	Infection of amputation stump
Additional Codes	
Inclusions	
Y60–Y84	Complications of medical and surgical care (refer to Appendix 6)

For the descriptions of external cause codes of complications of medical or surgical care (Y60–Y84), please refer to the technical notes: Hospital Harm Indicator: Appendices to Indicator Library.

Overview and Implications

A Post Procedure infection is associated with a medical or surgical procedure and results from colonization with a bacterial load greater than the capability of the immune system to manage. These infections can significantly increase cost, morbidity and even mortality.

Surgical Site infections are most commonly caused by *Staphylococcus*, Streptococcus, and Pseudomonas bacteria. Any surgery that causes a break in the skin or mucosa can lead to a postoperative infection. Surgical site infections are a frequent cause of morbidity following surgical procedures. Surgical site infections have also been shown to increase mortality, readmission rates, length of stay, and costs for patients who incur them. In the United States, the rate of surgical site infection averages between two to three per cent for clean cases (Class I/Clean as defined by CDC), and an estimated 40 to 60 per cent of these infections are preventable. Surgical site infection is the most common healthcare associated infection among surgical patients, with 77 per cent of patient deaths reported to be related to infection (Cataife et al., 2014).

In Western countries, between two to five per cent of patients undergoing clean surgical procedures and up to 20 per cent of patients having intra-abdominal surgical procedures will develop a surgical site infection (Auerbach, 2011). Infected surgical patients are twice as likely to die, spend 60 per cent more time in the intensive care unit, and are five times more likely to be readmitted to hospital after initial discharge (Kirkland et al., 1999). Such infections result in 3.7 million extra hospital days and U.S. $1.6 to $3 billion in excess hospital costs per year (Kirkland et al., 1999 and Martone et al., 2001).

Knee and hip replacements are two of the most commonly performed surgeries in the United States, with more than 1.1 million combined cases performed annually. It is estimated that between 6,000 and 20,000 surgical site infections (SSIs) develop each year in the U.S. after knee and hip replacements, and these numbers are expected to rise (Hussaini, Martin, 2013).

Infective endocarditis (IE) is an infection of the endocardium, particularly affecting the heart valves, caused mainly by bacteria but occasionally by other infectious agents. IE can be caused by several different organisms, many of which could be transferred into the blood during an interventional procedure (Centre for Clinical Practice at NICE, 2008). IE often affects older patients who often develop IE as the result of healthcare-associated procedures. It can occur in patients with no previously known valve disease or in patients with prosthetic valves (Habib et al., 2009).

Endocarditis is a rare condition, with an annual incidence of fewer than 10 per 100,000 cases in the general population. Despite advances in diagnosis and treatment, IE remains a life-threatening disease with significant mortality (approximately 20 per cent) and morbidity (Centre for Clinical Practice at NICE, 2008).

Central Line-Associated Bloodstream Infections (CLABSIs): Central venous catheters (CVCs) are increasingly being used in both in- and out-patient settings to provide long-term venous access. CVCs disrupt the integrity of the skin, making infection with bacteria and/or fungi possible. This infection may spread to the bloodstream and cause hemodynamic changes and

organ dysfunction (severe sepsis) to occur and, possibly lead to death. Approximately 90 per cent of the CLABSIs occur with CVCs. BSI may also occur in association with arterial catheters (*Safer Healthcare Now!* 2012).

Forty-eight per cent of intensive care unit (ICU) patients in the U.S. have central venous catheters, accounting for 15 million central-venous-catheter-days per year in U.S.-based ICUs. Studies of catheter-related bloodstream infections that control for the underlying severity of illness suggest that mortality attributable to these infections is between four per cent and 20 per cent. Thus, it is estimated that 500 to 4,000 US patients die annually due to bloodstream infections. Nosocomial bloodstream infections prolong hospitalization by a mean of seven days. Estimates of attributable cost per bloodstream infection are between U.S. $3,700 and $29,000. There are no equivalent Canadian figures for burden of illness (*Safer Healthcare Now!* 2012).

GOAL

To prevent Post Procedural infections and deaths in hospitalized patients by reliably implementing evidence-based procedural care for all patients undergoing invasive procedures.

IMPORTANCE TO PATIENTS AND FAMILIES

When patients get an infection following surgery, it delays healing, extends the patient's length of stay and increases their risk for harm and readmission. By implementing the appropriate interventions, patients are safer and go home sooner (IHI Improvement Map).

Most patients who have surgery do well, but about three out of every 100 surgery patients get an infection. This can lead to other problems such as a longer hospital stay and rarely, an infection related death (IHI, *How-to Guide: Prevent surgical site infections*, 2012).

Patient Stories

- Ginny's Story (Health Care For All, 2008)

  Ginny's life was changed forever by a preventable hospital-acquired infection.

- One Is Too Many: Viewing Infection Data from the Patient's Perspective (IHI)

  A surgical patient who contracted MRSA following knee replacement surgery describes the effects of the surgical site infection (SSI) on her life, and how her experience led her health care providers to make changes to prevent SSIs.

EVIDENCE-INFORMED PRACTICES

Prevention of Healthcare Associated Infections

1. Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Healthcare Settings (Public Health Agency of Canada, 2012).

Detailed information relative to routine practices and additional precautions are available from the Public Health Agency of Canada.

Prevention of Surgical Site Infections

Safer Healthcare Now! (2014) Four Key Components of Reliable Perioperative Care:

1. Antimicrobial Coverage Peri-Operatively:
    a. Appropriate use of prophylactic antibiotics; and
    b. Antiseptic prophylaxis.
2. Appropriate Hair Removal.
3. Maintenance of Perioperative Glucose Control.
4. Perioperative Normothermia.

Detailed information relative to the four key components above is available in the *Safer Healthcare Now!* Surgical Site Infection Getting Started Kit (2014).

Prevention of Central Line Associated-Bloodstream Infections

Safer Healthcare Now! Central Line Insertion Bundle (2012)

1. Hand Hygiene.
2. Maximal Barrier Precautions.
3. Chlorhexidine Skin Antisepsis.
4. Optimal Catheter Type and Site Selection:
    a. Avoid the femoral vein in adults; subclavian preferred to minimize infection risk.
    b. Optimal catheter type and site selection in children is more complex with the internal jugular vein or femoral vein most commonly used. Site preference in children needs to be individualized.

Safer Healthcare Now! Central Line Care Bundle (2012)

1. Daily Review of Line Necessity, with Prompt Removal of Unnecessary Lines.
2. Aseptic lumen Access.
3. Catheter Site and Tubing Care.

Detailed information relative to the bundle components above is available in the *Safer Healthcare Now!* Central Line Associated-Bloodstream Infection Getting Started Kit (2012).

Prevention of Surgical Site Infection for Hip and Knee Arthroplasty

(IHI, 2012; Anderson, 2014; *Safer Healthcare Now!* SSI, 2014)

Three Evidence-Based Interventions for Preventing SSI for Hip and Knee Arthroplasty:

1. Use an alcohol-containing antiseptic agent for preoperative skin preparation.
2. Instruct patients to bathe or shower with chlorhexidine gluconate (CHG) soap the night before and morning of surgery.
3. Screening for *S. aureus* and decolonizing surgical patients with an antistaphylococcal agent in the preoperative setting for high-risk procedures, including some orthopedic and cardiothoracic procedures has been proposed and supported by the Society for Healthcare Epidemiology of America (SHEA). Mupirocin nasal ointment along with chlorhexidine soap has the ability to nearly suppress *S. aureus* from the nasal sites.

For more information regarding preventative practice for periprosthetic joint infections refer to the Proceedings of the International Consensus Meeting on Periprosthetic Joint Infection (Parvizi, Gehrke, Chen, 2013).

Prevention of Infective Endocarditis

- A focused update dealing exclusively with the changes in recommendations for antibiotic prophylaxis against infective endocarditis in patients with valvular heart disease may be found in the ACC/AHA 2008 Guideline Update on Valvular Heart Disease (Nishimura et al, 2008).
- The 2008 guidelines of the American College of Cardiology/American Heart Association for the Management of Adults with Congenital Heart Disease provide recommendations for prevention of infective endocarditis and endocarditis prophylaxis (Warnes et al., 2008).
- The Centre for Clinical Practice at the National Institute for Health and Clinical Excellence (UK) (2008) has guidelines for the use of antimicrobial prophylaxis against infective endocarditis in adults and children undergoing interventional procedures.

Prevention and Management of Open Surgical Wounds

(Orsted et al., 2010)

Cause:

1. Complete a holistic assessment to identify factors that may affect surgical wound healing in the pre-operative, intra-operative and post-operative phases.
2. Create a treatment plan to eliminate or reduce factors that may affect surgical wound healing in the pre-operative, intra-operative and post-operative phases of care.

Patient-centered concerns:

3. Include the patient, family and/or caregiver as members of the team when developing care plans.
4. Educate the patient, family and/or caregiver to optimize surgical wound healing.

5. Assess the surgical wound and document findings using a standardized approach.
6. Debride the surgical wound of necrotic tissue.
7. Rule out or treat a surgical site infection.
8. Provide optimal local wound moisture balance to promote healing by choosing an appropriate dressing for the acute and chronic phases of surgical wound healing.

Re-evaluation:

9. Determine the effectiveness of interventions and reassess if healing is not occurring at the expected rate. Assess the wound edge and rate of healing to determine if the treatment approach is optimal.
10. Consider the use of adjunctive therapies and biologically active dressings.

Organizational concerns:

11. Recognize that surgical wound healing requires a team approach.
12. Implement a surgical site surveillance program that crosses clinical setting boundaries.

MEASURES

Vital to quality improvement is measurement, and this applies specifically to implementation of interventions. The chosen measures will help to determine whether an impact is being made (primary outcome), whether the intervention is actually being carried out (process measures), and whether any unintended consequences ensue (balancing measures).

Below are some recommended measures to use, as appropriate, to track your progress. In selecting your measures, consider the following:

- Whenever possible, use measures you are already collecting for other programs.
- Evaluate your choice of measures in terms of the usefulness of the final results and the resources required to obtain them; try to maximize the former while minimizing the latter.
- Try to include both process and outcome measures in your measurement scheme.
- You may use different measures or modify the measures described below to make them more appropriate and/or useful to your particular setting. However, be aware that modifying measures may limit the comparability of your results to others.
- Posting your measure results within your hospital is a great way to keep your teams motivated and aware of progress. Try to include measures that your team will find meaningful and exciting (IHI, 2011).

For more information on measuring for improvement, contact the Canadian Patient Safety Institute Central Measurement Team at measurement@cpsi-icsp.ca

Outcome Measure

(*Safer Healthcare Now!* 2015)

1. Percentage of Clean and Clean Contaminated Surgical Patients with Surgical Infection (*Safer Healthcare Now!* 2014).
2. Percentage of Surgical Procedures with Surgical Infection.
3. Central Line-Associated Primary Bloodstream Infection (BSI) Rate per 1,000 Central-Line Days (*Safer Healthcare Now!* 2012).
4. Incidence of HAI-MRSA Clinical Isolates per 1000 Patient Days (*Safer Healthcare Now!* 2010).
5. Incidence of HAI-VRE Clinical Isolates per 1000 Patient Days (*Safer Healthcare Now!* 2010).
6. Incidence of HAI-CRE Clinical Isolates per 1000 Patient Days.
7. Incidence of HAI-CDAD Positive Toxin Assay per 1000 Patient Days (*Safer Healthcare Now!* 2010).

Process Improvement Measures for Surgical Site Infections

(*Safer Healthcare Now!* 2014)

1. Percentage of Clean and Clean-Contaminated Patients with Timely Prophylactic Antibiotic Administration.
2. Percentage of Clean and Clean-Contaminated Patients with Appropriate Prophylactic Antibiotic Discontinuation.
3. Percentage of Surgical Patients with Appropriate Hair Removal.
4. Percentage of All Diabetic or Surgical Patients at Risk of High Blood Glucose with Controlled Post-Operative Serum Glucose Post Op Day 0, 1, and 2.
5. Percentage of All Clean or Clean-Contaminated Surgical Patients with Normothermia within 15 Minutes prior to Skin Closure or on Arrival in Post Anaesthetic Care Unit.
6. Percentage of Clean and Clean-Contaminated Patients with Pre-Op Wash With Soap or Antiseptic Agent.
7. Percentage of Clean and Clean-Contaminated Surgical Patients with Appropriate Intra-Op Skin Cleansing on Intact Skin.
8. Percentage of Clean and Clean-Contaminated Patients Receiving 2 grams of Cefazolin as Prophylactic Antibiotic.
9. Percentage of Clean and Clean-Contaminated Surgical Patients Receiving Appropriate Prophylactic Antibiotic Redosing.
10. Percentage of Clean and Clean Contaminated Surgical Patients with Evidence of Surgical Site Infection at or Prior to Discharge.

11. Percentage of Clean and Clean Contaminated Surgical with Appropriate Selection of Prophylactic Antibiotics (Optional).

Process Improvement Measures for Central Line Associated Bloodstream Infections

(*Safer Healthcare Now!* 2012)

1. Central Line Insertion Bundle Compliance:
    a. Hand hygiene.
    b. Maximal barrier precautions.
    c. Chlorhexidine skin antisepsis.
    d. Optimal catheter type and site selection.
2. Central Line Maintenance Bundle Compliance:
    a. Daily review necessity for line with prompt removal of unnecessary lines.
    b. Accessing the lumens aseptically.
    c. Catheter site and tubing care.

Process Improvement Measures for Hand Hygiene

(*Safer Healthcare Now!* 2010)

1. Percentage of Appropriate Hand Hygiene Practice.

Process Improvement Measures for Wound Care

(Orsted et al., 2010)

1. Percentage of Patients Undergoing a Surgical Wound Healing Risk Assessment.
2. Percentage of Patients Who Had An Individualized Treatment Plan to Eliminate and Reduce Risk Factors.
3. Percentage of Patients/Family/Caregivers Who Received Surgical Wound Healing Education.
4. Percentage of Patients Who Had Surgical Wound Assessment and Documentation Starting 48 Hours Post-Op.
5. Percentage of Patients with Appropriate Dressing for the Acute Phase of Surgical Wound Healing.

Standards and Required Organizational Practices

Accreditation Canada Standards

Accreditation Canada Standards include several requirements with regard to infection prevention and control including: providing information to clients about how to protect themselves from infections; conducting risk assessments; using procedure-specific care maps or guidelines; following routine practices; administering prophylactic antibiotics; using airborne, droplet and contact precautions; reprocessing; etc.

Accreditation Canada Required Organizational Practice

Hand-Hygiene Compliance: Requires the evaluation of compliance with accepted hand-hygiene practices.

Global Patient Safety Alerts

Global Patient Safety Alerts provides access and the opportunity to learn from other organizations about specific patient safety incidents including alerts, advisories, recommendations and solutions for improving care and preventing incidents. Learning from the experience of other organizations can accelerate improvement.

Recommended search terms:

- Infection
- Inflammatory reaction
- Post-procedure complication
- Wound infection
- Surgical wound infection
- Surgical site infection
- Prosthesis-related infections

Success Stories

BC Patient Safety & Quality Council

The *Safer Healthcare Now!* SSI Getting Started Kit (2014) is making a huge impact on safe surgical care. Surgical teams can take the information from the kit and run with it. Implementing safe surgical care varies from setting to setting and the surgical team has to decide how to do it and who does what. “The Getting Started Kit provides the evidence, but the how is what we leave up to the frontline teams, because that is where the wisdom is,” says Marlies van Dijk, (former) Director, Clinical Improvement (BC Patient Safety & Quality Council).

Preventing surgical site infections is a priority across British Columbia and culture is considered an essential factor to reduce harm. The BC Patient Safety & Quality Council is coordinating the National Surgical Quality Improvement Program (NSQIP) – a surgeon-led initiative where 24 hospitals are using a rigorous measurement tool to look at risk-adjusted surgical outcomes to

help foster that culture change. The initiative focuses on the hospital or unit as a learning system and continually looks at process and outcome data to drive improvement.

As most infections appear post-discharge, the cornerstone of the program is a 30-day post-operative chart review and follow-up with surgical patients. The NSQIP analysis of 19 out of 24 hospital sites in British Columbia identified areas for improvement and indicated there was a potential for saving between 7,700 to 31,000 patient days per year across the province.

The BC Patient Safety & Quality Council is building a reliability culture to reduce SSI. The successful strategies focus on frontline and clinical ownership. Shifting ownership and decision-making to the frontline is essential to improving results.

“By looking at the adaptive side of clinical care we can bring our SSI rates under control,” says Marlies. “We need to talk about safe surgical care differently and focus on culture, leadership and engagement. We have an obligation to our patients to ensure that best practices are being provided and this approach is very doable.” (*Safer Healthcare Now!* One Pager, 2014)

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POST-PROCEDURAL INFECTIONS RESOURCES

*(key resources as recommended by Dr. Claude Laflamme)

Professional Associations and Helpful Websites

- Canadian Patient Safety Institute, Surgical Site Infection http://www.patientsafetyinstitute.ca/en/Topic/Pages/Surgical-Site-Infection-(SSI).aspx
- Centers for Disease Control and Prevention, Surgical Site Infection http://www.cdc.gov/HAI/ssi/ssi.html
- Institute for Healthcare Improvement, Surgical Site Infection http://www.ihi.org/topics/ssi/pages/default.aspx

Post-procedural Infection Clinical Practice Guidelines

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Additional Resources for Prevention of Post-procedural Infections

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