Reducing Harm | Improving Healthcare | Protecting Canadians

PREVENT SURGICAL SITE INFECTIONS

Getting Started Kit

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Safer Healthcare Now!

We invite you to join *Safer Healthcare Now!* to help improve the safety of the Canadian healthcare system. *Safer Healthcare Now!* is a national program supporting Canadian healthcare organizations to improve safety through the use of quality improvement methods and the integration of evidence in practice.

To learn more about this intervention, to find out how to join *Safer Healthcare Now!* and to gain access to additional resources, contacts, and tools, visit our website at www.saferhealthcarenow.ca

This Getting Started Kit (GSK) has been written to help engage your interprofessional/interdisciplinary teams in a dynamic approach for improving quality and safety while providing a basis for getting started. The Getting Started Kit represents the most current evidence, knowledge and practice, as of the date of publication and includes what has been learned since the first kits were released in 2005. We remain open to working consultatively on updating the content, as more evidence emerges, as together we make healthcare safer in Canada.

Note:

The Quebec Campaign: *Together, let's improve healthcare safety!* works collaboratively with *Safer Healthcare Now!*. The Getting Started Kits for all interventions used in both *Safer Healthcare Now!* and the Quebec Campaign are the same and available in both French and English.

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Prevent Surgical Site Infections
GSK Contributors

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The Evidence

Introduction

Canadian healthcare continues to struggle with surgical site infections (SSI). Despite advances in aseptic technique, antibiotic prophylaxis, and less invasive surgical techniques, healthcare associated infections (HAI) continue to complicate the recovery of many surgical patients. The recommendations contained in this Getting Started Kit are designed to assist healthcare facilities in prioritizing and implementing surgical site infection prevention efforts. These recommendations are primarily based on HAI prevention guidelines published by numerous health organizations, including NICE, SHEA, CDC, WHO, and relevant research literature published after these guidelines. The focus of this kit is to highlight the core SSI prevention bundle elements featured in the extant literature, however due to space constraint this bundle is not inclusive of all SSI prevention strategies.

Background

Goals to Prevent Infections

Prevent surgical site infections by implementing four components of care:

1. Antimicrobial coverage perioperatively;
    a. Appropriate use of prophylactic antibiotics
    b. Antiseptic prophylaxis
2. Appropriate hair removal;
3. Maintenance of perioperative glucose control;
4. Perioperative normothermia.

The Case for Preventing Surgical Site Infections

Surgical site infection is the most common healthcare associated infection among surgical patients, with 77% of patient deaths reported to be related to infection[1]. Such infections result in 3.7 million excess hospital days and US $1.6-3 billion in excess hospital costs per year[3, 4].

In Western countries, between 2 to 5% of clean cases and up to 20% of intra-abdominal surgeries will develop a surgical site infection[2]. Infected surgical patients are twice as likely to die, spend 60% more time in the intensive care unit, and are five times more likely to be readmitted to hospital after initial discharge[3].

Preventing Surgical Site Infection: Four Components of Care

1. Perioperative Antimicrobial Coverage

a. Appropriate Use of Prophylactic Antibiotics

One of the most important interventions in preventing surgical site infections is the optimization of antimicrobial prophylaxis. Appropriate use of antibiotics has been shown to reduce surgical site infections[1, 5-16]. While the necessity and efficacy of preoperative prophylactic antibiotics are not in question, the type, dose, timing, and duration of antibiotic prophylaxis continue to be debated in the literature.

Where are we now?

The Surgical Care Improvement Project (SCIP) reported the following US national averages for the fourth quarter of 2007. These data are self-reported by hospitals but are subject to validation review[17].

- Antibiotics are given within 1 hour of surgery 89.5% of the time, on average (benchmark 99%).
- Correct antibiotics are given 95.2% of the time, on average (benchmark 99.5%).
- Antibiotics are discontinued within 24 hours of the end of surgery 86.2% of the time, on average (benchmark 98.2%).

(i) Timing

All systemic antibiotic infusions must be started and completed within 60 minutes of first incision[18], except vancomycin and fluoroquinolones which need to be infused over more time (120 minutes) to avoid Red Man Syndrome. However, vancomycin infusions must be completed no more than 60 minutes prior to first incision. This allows time to achieve minimum inhibitory concentration (MIC) of antibiotic in serum and tissue levels from the start of surgery. Re-dosing of antibiotics may be required during prolonged surgeries (more than 4 hours) in order to maintain therapeutic levels perioperatively. This strategy will contribute to the reduction of surgical site infections[1].

Canadian healthcare facilities who have reported a high rate of success with timely prophylactic antibiotic administration often reassign antibiotic administration responsibilities to anesthesia or holding area nursing staff in order to optimize timing of antibiotic delivery (see Canadian story below).

Canadian Story: Antibiotic Prophylaxis

In 2009, William Osler Health System (services areas of Etobicoke, Peel & Brampton, Ontario) identified that compliance with prophylactic antibiotic administration and documentation for total joint arthroplasty surgeries was 27%. In response, they implemented the following process:

1. Pre-printed antibiotic order set used;
2. Day surgery starts IV and hangs the antibiotic (but doesn't infuse);
3. All antibiotics started in the OR by the anesthesiologist, with the exception of vancomycin, started in Day Surgery;
4. Antibiotic administration (type & timing) verified as part of the Surgical Safety Checklist that is conducted prior to all surgeries;
5. Anesthesiologist to start the antibiotic prior to incision;
6. Antibiotic documented in both electronic record and paper copy (anesthesia record).

The biggest challenge of implementing this process was getting everyone to chart in one location. The data were aggregated bimonthly by the Infection Prevention and Control Department. The results were posted on the external website, were disseminated to front-line and senior OR staff, and were tracked at monthly Quality Information Network meetings. After seven months, antibiotic prophylaxis was administered and documented correctly 95% of the time.

Antibiotic Prophylaxis during Caesarean Section

Despite the use of antibiotic prophylaxis, infections are one of the five leading causes of pregnancy related mortality in the world[19]. A recent meta-analysis revealed that women undergoing a caesarean section (c-section) are 5 to 20 times more likely to get an infection compared with those who have a vaginal deliver[20]. Up to 80% of caesarean delivery related infections go unrecognized due to post-discharge onset and lack of outreach surveillance[21, 22](see Canadian Story – SSI Surveillance, pg 21).

Several publications have shown a reduction in maternal infection rates when the prophylactic antibiotic was given within 60 minutes of incision vs. after cord clamping[19, 23-25]. WHO, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists have indicated that administering prophylactic antibiotics during the hour before incision rather than waiting until umbilical cord clamping may be more effective. Yet, the CDC[1], and NICE[26] guidelines still recommend that prophylaxis be given after cord clamping.

Neonate. The neonatal concerns often cited to justify the practice of administering prophylactic antibiotics after cord clamping have not been validated by prospective trials. On the contrary, clinical trials have demonstrated no increase in neonatal sepsis, sepsis workups or neonatal intensive care unit (NICU) admissions[25]. More recent research has actually shown a decreased trend in NICU admissions in neonates whose mothers received antibiotics prior to skin incision[24].

Evidence to practice. Based on the findings, a change in policy regarding the timing of prophylactic antibiotics from post cord clamping to pre–incision was implemented in an academic center in the US in 2006[27]. An overall SSI rate reduction of 67%, primarily due to reduction in endometritis, was achieved during the year following a change in timing of antibiotic prophylaxis to before incision.

In Canada, current practice is moving toward antibiotic prophylaxis prior to incision for c-sections. Some of the institutions that have already implemented this practice include (not exhaustive):

- Sunnybrook Health Sciences, Toronto, Ontario
- North York General Hospital, Toronto, Ontario
- Surrey Memorial Hospital, Fraser Health Authority, British Columbia
- Alberta Health Services, Acute Care Hospitals, Edmonton, Alberta

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that prophylactic antibiotic administration be started and completed within 60 minutes of first incision for c–sections instead of after cord-clamping.

Antibiotic Prophylaxis with Tourniquet Application

Governing bodies recommend that the complete dose of prophylactic antibiotics be infused prior to inflation of a tourniquet[26, 28, 29]. If the antibiotic is fully infused 30-60 minutes prior to incision, its effect will be maximized[30, 31].

Some researchers suggest that tourniquet use may impair the prophylactic efficacy of antibiotics administered before tourniquet inflation[32, 33]. They suggest that if the antibiotic is administered at the moment the tourniquet is released, the concentration of antibiotic in the blood bathing the wound would be high. Currently there is no conclusive evidence to indicate a change in practice.

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that a prophylactic antibiotic infusion be started and completed within 60 minutes for cephalosporins (cefazolin) and infused over 120 minutes for vancomycin and fluoroquinolones prior to application of tourniquet to maximize antibiotic efficacy.

(ii) Dosing

There is limited published data on appropriate antimicrobial dosing for prophylaxis. The dosage of the antibiotic needs to be adequate based on the patient's body weight, adjusted dosing weight, or body mass index[34]. Additional doses may be necessary during prolonged surgery in order to ensure an adequate antimicrobial level until wound closure.

Weight Based Dosing

Rationale and expert opinion point to the adoption of weight based dosing as an added strategy to lower SSI rates. There is evidence that applying weight based dosing to cefazolin and vancomycin surgical prophylaxis regimens will lower SSI rates among obese patients[35]. However, there are pharmacokinetic considerations that pose challenges when determining adequate dosages of antibiotics in obese patients[36].

It appears the most common weight based dosing regimen practiced in Canadian hospitals surveyed is 2 grams of cefazolin for people weighing more than 80 kg. However, there is current discussion evolving that questions whether 1 gm of Cefazolin is adequate for normal weight adults – and some institutions in North America are moving to a standard protocol of giving 2 grams of Cefazolin for all surgical adult patients even though sufficient evidence has not been published at this point. Table 1 features the weight-based dosing practices of several Canadian healthcare facilities (this list is not exhaustive).

Table 1. Examples of Canadian Weight-based Antibiotic Protocols

Healthcare Facility	Cefazolin	Vancomycin
Fraser Health Authority, Vancouver, British Columbia	1g IV if ≤80kg 2g IV if >80kg	Not Available
Edmonton and Area Acute Care Facilities, Alberta Health Services, Alberta	1g IV if ≤100kg 2g IV >100kg	Vancomycin 1g for everyone
Grace Hospital, Winnipeg Regional Health Authority, Winnipeg, Manitoba	1g IV if <80kg 2 g IV if ≥80kg	1g IV if ≤75kg 1.25g IV if 76-94kg 1.5g IV if ≥95kg
University Health Network, Toronto, Ontario	1g IV <70kg 2g IV if ≥70kg	Not Available
North York General Hospital, Toronto, Ontario	1g IV if ≤80kg 2g IV if >80kg	No weight-based modifications
Sunnybrook Health Sciences, Toronto, Ontario	2g for everyone	Not Available
Jewish General Hospital, Montréal, Quebec	2g for everyone	Weight modifications based on renal sufficiency
St. Clare's Mercy Hospital, St. John's, Newfoundland	1g IV if ≤80kg 2g IV if >80kg	Not Available
Horizon Health Network, Moncton, New Brunswick	1g IV if ≤100kg 2g IV >100kg	Not Available

(iii) Duration

Single Dose Antibiotic Prophylaxis

Institutions across the country are starting to adopt single dose prophylaxis for non-complex surgeries. Published literature on antibiotic prophylaxis shows that for non-complex and uncomplicated surgical cases a single dose of antibiotic may be sufficient in preventing infections[37-47]. The Medical Letter Treatment Guidelines state the following: "most Medical Letter consultants believe that postoperative doses are usually unnecessary and can increase the risk of antimicrobial resistance"[48]. Yet, there is no definitive evidence that this be adopted as a general rule for *all* types of surgery, therefore guidelines from international organizations (CDC, NICE, WHO and SHEA) are not emphatic in recommending single dose prophylaxis[1, 18, 26, 29]. Many local institutions are giving prophylaxis up to 24 hours post-operatively for cardiac, thoracic, orthopaedic, and vascular surgery. At this point, the literature has not shown whether single dose prophylaxis is equal or superior to 24 hour regimens in preventing surgical infections for all major surgeries.

Antibiotic resistance: Potential negative impact of prophylactic antibiotics

While there are no higher adverse effects with the use of antibiotic prophylaxis up to 24 hours postoperatively, there are risks associated with administration of prophylaxis for more than 24 hours. Patients on prolonged prophylaxis are more likely to harbour antibiotic resistant bacteria[49-52], which underscores the importance of good antimicrobial stewardship.

Limiting the duration of surgical antibiotic exposure should curtail antimicrobial resistance and other forms of collateral damage, such as *Clostridium difficile*-associated disease (CDAD)[1, 50, 53]. The literature suggests that while there are some risks associated with antibiotic prophylaxis, the risk of post-operative surgical site infection still outweigh the risk of developing CDAD. The *Safer Healthcare Now!* SSI faculty encourage teams to continue with prophylaxis where recommended. A potential balancing measure is to monitor side effects of prophylaxis by working with your infection control department and monitoring the incidence of CDAD and MRSA.

What changes can we make that will result in improvement?

- Use pre-printed or computerized standing orders specifying choice of antibiotic, dose, timing, and discontinuation.
- Change operating room drug stocks to include only standard doses and standard drugs, reflecting locally agreed upon guidelines.
- Reassign antibiotic administration responsibilities to anesthesia or holding area nursing staff to improve timeliness.

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* faculty recommend that prophylactic antibiotics be completely absorbed within 60 minutes of first incision, and should be repeated for surgeries lasting longer than the half-life of the antibiotic (4 hours for cephalosporins). Antibiotics administered for cardiac, thoracic, orthopaedic and vascular patients should be discontinued within 24 hours of the end of surgery, whereas non-complex and uncomplicated surgeries require no further administration of antibiotics following surgery.

b. Antiseptic Prophylaxis

Skin preparation plays a significant role in the prevention of SSI. A primary source of infection following surgery is the bacteria on a patient's skin[54]. The aim of skin preparation is to eliminate and rapidly kill skin flora at the site of a planned surgical incision.

Perioperative antiseptics are currently delivered in a variety of ways: mouthwash, body wash, skin prep of the surgical site, as well as wound care. Acceptable antiseptic agents include alcohol, chlorhexidine, iodine, and iodophors (povidone-iodine). The ideal pre-operative skin antiseptic agent should: (1) significantly reduce microorganisms on intact skin, (2) be non-irritating to the skin, (3) be broad spectrum, (4) be fast acting, (5) have a persistent effect, (6) remain effective in the presence of organic material (blood and body fluid), and (7) be cost effective[55, 56].

Chlorhexidine Surgical Skin Preparation

Chlorhexidine and povidone-iodine are the most commonly used antiseptic compounds. While both are safe and effective for skin disinfection, 2% chlorhexidine with 70% isopropyl alcohol (CHG/IPA) has repeatedly been shown to be a more effective surgical skin preparation solution than any other bactericidal agent to which it has been compared[57-61]. The properties that make chlorhexidine highly effective are a strong affinity for binding to the skin, high antibacterial activity, and prolonged residual effects on rebound bacterial growth[62]. Alcohol based chlorhexidine antiseptic solutions significantly reduce the likelihood of wound, catheter, and surgical site colonization and maximize the rapidity, potency and duration of bactericidal activity when compared to other solutions[63]. Not only is chlorhexidine superior in reducing bacterial colony counts, but recent research has shown substantive evidence that alcohol based chlorhexidine antiseptic solution is superior to povidone-iodine in preventing surgical site infections[59].

Further, in contrast to iodophors, chlorhexidine does not become inactivated in the presence of organic material, such as blood, pus, and body fluids[64]. In order to maximize the effects of chlorhexidine, both the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Disease Society of America (IDSA) recommend that chlorhexidine not be washed off following application[65]. Currently, operating rooms across the country are predominantly using povidone-iodine but a switch to chlorhexidine could have a significant impact on the prevention of SSI.

Cost/benefit ratio. Darouiche and colleagues (2010) calculated that the average cost of using CHG-alcohol applicators (2) was US $9 per patient more than the cost of using a povidone-iodine prep tray ($3 US)[66]. Yet they also found that CHG-alcohol prevents at least 6 more cases of infection per 100 patients than povidone-iodine. In other words, only 17 patients

would need to have skin preparation with CHG-alcohol solution instead of povidone-iodine in order to prevent one SSI[66]. The additional cost for CHG-alcohol applicators for 100 patients is significantly less than the cost of treating 6 patients with SSIs[66].

Caution with Alcohol-Based Solutions

Fire hazard. Fires in the OR can have devastating consequences for both patients and staff. While fires in the OR are extremely rare, alcohol based antiseptics are flammable, therefore the *Safer Healthcare Now*! faculty recommend that the following precautions be taken when using alcohol based antiseptic skin prep solutions:

- Staff need to be educated before using a CHG-alcohol solution on how to be safe and effective in their application of a flammable skin prep agent
- Avoid dripping or pooling of alcohol based antiseptic solutions on sheets, padding, positioning equipment, adhesive tape, and on or under the patient (umbilicus, groin)[55].
- Ensure that the liquid has completely dried by evaporation – 3 minutes is usually sufficient[26, 55]. Areas with excess hair may take longer to dry. Healthcare facilities utilizing alcohol based surgical prep solutions should develop protocols that ensure and document that the applied solution is completely dry before draping the patient (i.e. add to preoperative surgical checklist). Some sites across the country are using the "time out phase" of the surgical checklist to allow chlorhexidine-alcohol skin prep solution to dry. An ideal surgical checklist has three phases: briefing, time out and debriefing.
- Single-use applicators should ideally be used to apply flammable prep agents. For head and neck procedures, use an applicator with less volume to avoid excess. This limits the amount of pooling on or under the patient[55].
- Surgical team members need to communicate to each other when a flammable prep agent is used.

Pre-op & Post-op: Antiseptic Cleanse

Although preoperative bathing (whole-body disinfection) with antiseptic agents has not been shown to reduce the incidence of SSI rates[1, 18, 67], it has been shown to reduce bacterial counts on the skin[68]. Several studies have investigated the antimicrobial efficacy of a no-rinse, disposable washcloth impregnated with 2% chlorhexidine gluconate[69-72]. The findings from these studies suggest that daily cleaning with chlorhexidine impregnated disposable cloths may be a simple and effective strategy to reduce catheter-related bloodstream infection and bacterial colonization of resistant organisms. While cost is currently a consideration with this product, recent research[70, 73] has shown that SSI rates were reduced by at least 50% when 2% CHG impregnated cloths were part of the bundle of care. Currently there is a lack of direct comparative research to other antiseptic products.

Skin sensitivities/allergies. Chlorhexidine is well tolerated and has shown a low incidence of hypersensitivity and skin irritation[63]. Rare cases of severe allergic reactions, including anaphylaxis, have been reported[74-76]. Caution should be exercised to avoid direct contact with the eye[77], inside of the ear[78] (to avoid vestibular- and ototoxicity), or with neural tissue.

Children. Alcohol-based chlorhexidine solution (2% CHG/70% IPA) has been approved by both the US FDA and Health Canada for children 2 months or older. Recently released SHEA guidelines recommend that infants older than two months of age be bathed with chlorhexidine for the prevention of hospital acquired infections, specifically for prevention of central line blood stream infections and to prevent MRSA transmission[65].

Canadian Story: Antimicrobial Prophylaxis

The Cardiac Surgery Program at the Foothills Medical Centre in Calgary, Alberta observed SSI rates in the 2-3% range during 4 years of surveillance, despite optimal antibiotic prophylaxis and povidone–iodine surgical site antisepsis. Subsequent implementation of a care bundle, including a variety of chlorhexidine gluconate (CHG)-based products pre-, intra-, and postoperatively, resulted in both a decrease in sternal deep organ space infection rates from 3.1% to 0.8% (p = 0.0002), and in donor site infection rates (zero infections in the last quarter). The care bundle includes the following:

1) audit of the clinical environment; 2) adoption of protocol using a 2% chlorhexidine gluconate impregnated no-rinse disposable cloth pre-operatively; 3)adoption of chlorhexidine based mouthwash pre-operatively and post-operatively twice daily until extubated; 4) change to 2% chlorhexidine gluconate/70% IPA tincture surgical skin prep; 5) change to post-operative patient bathing with Comfort Bath (chlorhexidine based body wash) while in CVICU, on the ward a clean basin each day, or a low level disinfected sink; and 6) wound care practice changes including daily dressing change using aseptic technique until all invasive lines are out, and wound is healed. These findings reinforce that multiple small practice changes (a bundle approach) can have a positive impact on surgical outcomes.

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that the skin should be cleansed before surgery with a chorhexidine–based solution, preferably with no rinse disposable chlorhexidine gluconate impregnated wash cloths.

The antiseptic of choice for surgical skin preparation should be alcohol based chlorhexidine antiseptic solutions instead of povidone-iodine. Following application of chlorhexidine-alcohol skin prep solution, surgical teams should allow several minutes for the skin prep to dry prior to first incision. To maximize its efficacy, CHG-alcohol skin prep should not be washed off for at least 6 hours following surgery.

In order to prevent a fire hazard, it is imperative that CHG-alcohol skin prep be allowed to air dry for at least 3 minutes, or longer if there is excessive hair insitu. Povidone-iodine should be used as a skin preparation in emergent cases when there is not enough time to allow CHG-alcohol solution to completely dry before incision. Chlorhexidine-alcohol solutions must *not* be used for procedures involving the ear, eye, mouth or neural tissue.

2. Appropriate Hair Removal

The use of razors (shaving) prior to surgery increases the incidence of wound infection when compared to clipping, depilatory use, or no hair removal at all[63, 79-81]. According to WHO guidelines[29], hair should not be removed unless it interferes with the surgical procedure. The literature indicates that clipper use is sufficient for any body part and that razor use is not appropriate for any operative site. Clippers should be used as close to the time of surgery as possible[1]. Hair removal should take place outside of the operating room[55].

In 2007, the Jewish General Hospital in Montréal, Quebec implemented a surgical site infection prevention protocol that included showering after clipping of the surgical site in order to limit contamination of the wound.

What changes can we make that will result in improvement?

- Involve staff in the selection of clippers
- Update policy and procedure to include use of clippers instead of razors
- Remove all razors from the hospital once clippers have been introduced
- Educate staff on hair removal:
    - If hair needs to be removed, it should be clipped less than 2 hours before surgery[29]. Use electric or battery-powered clipper that can be fully submersed and disinfected between patient use with disposable or re-useable heads[55]
    - Due to increased risk of bacterial contamination of the surgical site, loose clipped hair should be showered off the body or removed with stick mitts immediately following the clipping procedure
    - Ideally, hair removal should be performed in an area outside of the room where the surgical procedure will be performed[55]
- Work with the purchasing department so that razors are no longer purchased by the hospital
- Use reminders (signs, posters)
- Educate patients not to shave preoperatively and incorporate this message into the preoperative patient information and surgeon's office communication

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that patients be educated not to shave in the vicinity of the incision for one week preoperatively. No hair removal prior to surgery is optimal. If hair removal is necessary, clippers should be used outside of the operating room theatre, but within the operating room department, within 2 hours of surgery. Do not use razors in the vicinity of the surgical area.

3. Maintenance of Perioperative Glucose Control† **

There is considerable observational evidence linking hyperglycemia‡ in hospitalized patients (with or without diabetes) to poor outcomes. Review of medical evidence shows that the degree of hyperglycemia in the postoperative period is correlated with the rate of SSI in patients undergoing major cardiac surgery[82, 83]. Recent literature has informed us that glucose control in all patients reduces the risk of infection[84, 85]. Previous research has endorsed strict glycemic control (blood glucose levels within a low, narrow range) perioperatively[86]. But, the optimal glycemic control regimen to prevent SSIs has recently been in question. Not only has there been no consistent reduction in mortality with strict control of glycemia in critical care patients[87, 88]; it has actually led to higher rates of hypoglycemia and increased mortality[89, 90]. Furthermore, a recent Cochrane meta-analysis found insufficient evidence to support the routine adoption of strict glycemic control (4.1-6.0mmol/L) over conventional management (<11.1 mmol/L) perioperatively for the prevention of SSIs[91]**.

Based on the evidence, the American Association of Clinical Endocrinologists and the American Diabetes Association have recently released a consensus statement on glycemic control in hospitalized patients[92]. In the intensive care unit (ICU), intravenous infusion is the recommended route of insulin administration for persistent hypergycemia. However, strict blood glucose levels (<6.1 mmol/L) should be avoided, and blood glucose should be maintained between 7.8 and 10 mmol/L for the majority of critically ill patients. Frequent glucose monitoring is essential to achieving optimal glucose control. Outside of the ICU, scheduled subcutaneous administration of insulin, with basal, nutritional, and correction components is preferred. Blood glucose targets before meals should be <7.8 mmol/L (and >3.9 mmol/L), and random blood glucose values should be <10 mmol/L.

What changes can we make that will result in improvement?

- All patients have a capillary blood glucose (CBG) level drawn in pre-op clinic
- Assign responsibility and accountability for blood glucose monitoring and control
- Diabetics, and anyone with a CBG >10 mmol/L should be flagged to have a repeat CBG day of surgery (these patients should have CBG done every 2 hours)
- CBG >10 mmol/L perioperatively – notify anesthesiologist or surgeon

RECOMMENDATION

Based on the evidence, The *Safer Healthcare Now!* SSI faculty recommend that postoperative blood glucose levels be checked on all surgical patients who are diabetic or have risk factors for diabetes. Teams are encouraged to apply glucose control to surgical populations as directed by your local organization.

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† Conventional glycemic control is defined as maintaining serum glucose levels below 10 mmol/L; one collected on each of the first two post operative days.

** Strict glycemic control (e.g., using an insulin drip) generally should be performed in an intensive care setting or equivalent.

‡ Hyperglycemia is defined as any blood glucose value >7.8mmol/L; hypoglycemia is defined as any blood glucose level <3.0 mmol/L) (Moghissi et al., 2009)

4. Perioperative Normothermia[§]

One of the most common complaints from people that have surgery is being cold – in the holding areas, the OR, and the PACU. General and neuraxial anesthesia impairs thermoregulatory control. Consequently, most patients who are not actively warmed will become hypothermic intra- and postoperatively. The medical literature suggests that patients undergoing surgery have a decreased risk of surgical site infection if normothermia is maintained during the perioperative period[93]. Anesthesia, anxiety, wet skin preparations, and skin exposure in cold operating rooms can all contribute to hypothermia.

Temperature Probes. Multiple temperature monitoring devices pose a concern when assessing temperatures across the pre-operative, intra-operative and post-operative areas of care. Normothermia entails keeping the patient's core temperature above 36 degrees celsius as they go through their surgical procedure. *Safer Healthcare Now*! adopts the definition of normothermia as maintaining a core temperature between 36ºC–38ºC. The gold standard areas for assessing core temperature are in the distal esophagus or naso-pharyngeal sites. However, other thermometers such as temporal and tympanic are capable of measuring accurate temperatures if utilized effectively (well trained clinician). There can be a discrepancy between temperatures measured by the gold standard method and the other methods. The discrepancy between temperatures is generally 0.2 degrees higher (temporal thermometer) or lower (tympanic thermometer) depending on the probe used.

What kind of changes can we make that will result in improvement?

Normothermia (core temperature 36ºC–38ºC) should be maintained preoperatively, intraoperatively, and in PACU by implementing any combination of the following:

- Pre-printed order sets
- warmed forced-air blankets when surgery is expected to last >30 minutes[94]
- Warmed Intravenous fluids for abdominal surgeries of >1 hour duration[94]
- Warmed lavage liquids for colorectal surgery
- Increase the ambient temperature in the operating room to 20ºC
- Hats and booties on patients during surgery
- Pre-warming should be initiated between 30 minutes to 2 hours prior to major surgery.

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§ Note that this component of care does not pertain to those patients for whom therapeutic hypothermia is being used (e.g., hypothermic cardioplegia).

Additional Resources for Normothermia

1. ASPAN Standards at American Society of Peri Anesthesia Nurses (www.aspan.org)
2. Mauermann, W.; Nemergut, E. The Anesthesiologist's Role, Anesthesiology 2006; 105:413-21
3. Sessler, D., Complications and treatment of mild hypothermia. Anesthesiology, 2001. 95: p. 531-43.
4. Frank, S., et al., Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events: A randomized clinical trial. JAMA, 1997. 277: p. 1127-34.

Canadian Story: Normothermia

In combination with several other SSI prevention initiatives, Sunnybrook Health Sciences Centre surgical and peri-anaesthesia teams set a goal to ensure all elective laparotomy patients maintain a core body temperature of at least 36ºC perioperatively (no more than 38ºC).

The following processes were implemented in an effort to achieve this goal:

- Educate patient service partners from Same Day Surgery area on which surgical procedures were eligible for warming prior to surgery
- A checklist of surgical procedures that require a forced air blanket preoperatively
- Preoperative pre-printed order sets (including order for forced air blanket) for all laparoscopic and laparotomy general surgery and surgical oncology procedures
- Individual surgeons and anaesthesiologists given data on their compliance with this best practice
- Room temperatures set at 21 degrees and monitored regularly in ORs
- Fluid warmers used for all lengthy general surgery cases

Software was implemented to track patients' temperature readings directly from monitors in the OR. However, despite availability of software, consistent measurement of core body temperature has remained a challenge. Compliance with this practice in general surgery/surgical oncology cases has improved from 55.87% (Q3 2006/07) to 73.1% (Q4 2008/09).

RECOMMENDATION

Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that measures are taken to ensure that surgical patient core temperature remain between 36.0ºC and 38.0ºC preoperatively, intraoperatively, and in PACU.

Nutrition & Wound Healing

Wound healing is compromised and post-operative complications are significantly increased in patients with moderate and severe malnutrition[95-97]. All patients should be screened for malnutrition either prior to or within 24 hours of admission[96] and consideration to provide adequate nutritional support should be given for patients with severe malnutrition undergoing elective surgery. Patients with moderate malnutrition should be closely monitored in the post-operative period so that timely and sufficient nutrition can be provided[98].

Post-Discharge SSI Surveillance

Canadian Story: SSI Surveillance

Significant morbidity is associated with surgical site infection. The majority of surgical site infections are detected after patients are discharged from hospital[1] and consequently, are not captured by hospital SSI surveillance.

Higher SSI rates at 30-days post-operatively were validated by recent work from the Health Quality Council of Alberta (HQCA). HQCA developed a tool linking electronic medical databases to retrieve SSI information from multiple electronic health records (surgery hospital records, inpatient records, physician billings, outpatient and emergency department visits).

Upon review of all Alberta billing data, HQCA found that between April 2002 and September 2007, the SSI rate estimates at 30 days ranged from 1.7 times higher (hip replacement and cardiac valve) to 5.2 times higher (c-sections) than those rates calculated based on hospital admission and readmission data.

National Context

Accreditation Canada (AC) plays a key role in urging healthcare organizations to follow evidence based practice. We have outlined below a summary of how AC is consistent with *Safer Healthcare Now!* definitions. Also, across the country, we are seeing provincial ministries playing larger roles with setting mandatory requirements for their healthcare organizations. The Ontario Ministry of Health and Long Term Care has instituted mandatory reporting around clinical topics such as SSI. Other provinces in the country are following suit.

Accreditation Canada

Accreditation Canada (AC) has performance measures in place for surgical site infections (2008). They focus on the rate of post-surgical infections and rate of timely administration of prophylactic antibiotics. The protocol attached to these measures allows an organization to select a surgical procedure that has the highest risk, highest surgical volume, or both. They recommend the following selected procedures to include:

- cardiac surgery
- colorectal surgery
- hysterectomy
- c-section
- total joint arthroplasty
- craniotomy
- CSF shunts
- spinal surgery

They recommend that the indicators of post op infection rates and timing of prophylaxis be applied to the same surgical procedure, but it is not a necessity.

The definition of both collecting postoperative surgical infection and timing of prophylaxis is synonymous with the *Safer Healthcare Now*! data collection measures. Accreditation Canada specifies for each organization to establish their own post operative surveillance time period. *Safer Healthcare Now!* recommends a 30 day post operative time period.

Ontario - Ministry of Health and Long Term Care

The Ministry of Health and Long Term Care of Ontario (MOHLTC) has instituted mandatory reporting of patient safety indicators, some of which are aligned with *Safer Healthcare Now!* measures.

The MOHLTC indictor refers to prophylactic antibiotic use to help prevent surgical site infections in hip and knee joint replacement surgeries. SSI data is to be reported for all primary total, partial and hemi hip and knee joint replacements (not revisions) by all hospitals performing these surgeries. Time for antibiotic administration will be measured from the antibiotic infusion start time to skin incision start time. The goal should be to have the antibiotic completely infused within 0 to 60 minutes of skin incision for regular antibiotics (such as cephalosphorins, i.e. clindamycin or cefazolin). For vancomycin the start time is extended to 0 to 120 minutes prior to skin incision.

The MOHLTC indicator for SSI (antibiotic timing) and the SHN measure for antibiotic timing are identical. *Safer Healthcare Now!* does not limit the population for this measure to hips and knees, but recommends reporting data separately for each population for which data is being submitted.

Measurement

Safer Healthcare Now! recommend that you obtain baseline data, before you begin implementing changes, to give your team and organization a picture of where you are starting from. If you are able to obtain baseline data, your team may decide to do a retrospective chart review, or use other sources, to establish baseline data. We recommend you collect a baseline for those select surgical procedures you have chosen to work on. We suggest that you take a "snapshot" of three months or more, or whatever is feasible for your organization. Please refer to the sampling suggestion in each of the Technical Descriptions (**Appendix B**). However, you may find that you are unable to find the information you need in the charts or through other sources. In this case you could engage in *real time* (concurrent) sampling to establish a baseline.

Appendix B contains further details on the technical descriptions of these measures, including definitions of terms, numerators, denominators, exclusions, and collection/sampling strategies.

Appendix B also contains a worksheet for each measure. The worksheets provide step-by-step tables for calculating the numerator, denominator, and final calculation for each measure. The worksheets are tools to help measure the progress over time and are to be used to follow baseline stage (before you have started to implement the bundles), early implementation and full implementation stages. It may be appropriate to collect some or all measures retrospectively, through chart review, but ideally your data will be collected concurrently.

Collection Strategy

Depending on your facility, the process measures (e.g. timely prophylactic antibiotic administration) mostly require new data collection. For some of the process measures it is possible to use data from the Discharge Abstract Database to identify the total number of selected surgical procedures (assuming that these are specified) and to exclude burns and

transplant patients. Conceptually, it would be possible to report the percentage of these with post-op wound infections, presuming that recent coding education sessions have ensured appropriate coding of SSI.

Some of the outcome measures can be derived from CIHI data. Please explore this possibility in your organization, as it would reduce data collection time.

Given the complexity of reducing the outcome measure of surgical site infections, *Safer Healthcare Now!* offers the following tips and suggestions:

- If a region or organization has the resources, SSI rates should be risk adjusted (implying that risk variables be measured on all cases of a procedure whether infection occurs or not). However, we recognize that this is not possible for all organizations.
- *SHN* considers SSI rates collected for clean and clean-contaminated (NHSN wound class one and two) a form of risk adjustment. *SHN* is not mandating risk adjustment using ASA scores, length of surgery or co-morbidities (other element of further risk adjustment). Risk adjustment practices vary across organizations; and as a result make comparison of SSI between organizations inaccurate. *SHN* does accept all levels of risk adjusted data; but will not use it for comparative purposes. The key to measuring improvement with SSI rates is to measure consistently over time and use your data for internal purposes.
- SSI rates need to be monitored on a long-term basis for trend. A normal variation may be noted in SSI rates even though prophylaxis compliance increases consistently.
- You will likely not see a reduction in SSI rates over a short period of time; we encourage teams to focus their change and interventions to improve the process measures of this SSI bundle.
- How consistently best practice is applied for every surgical case will directly influence SSI rates. For example: if proper hair removal occurs 10 % of the time vs. 90% of the time; over time this should affect your SSI rate. The application of the entire bundle 90% of the time is more likely to reduce SSI rates.
- There are other variables, beyond the four care components presented, which may affect SSI rates, such as: OR staff scrubbing technique, OR doors opening/closing, air quality, nutrition, and perioperative hyperoxia.
- IHI's recent experience with their SSI collaborative has shown that measuring the number of cases between infections (vs. percentiles) has proven easier (with the goal to double the number of cases between an infection).
- Work closely with your infection control department on this outcome measure of reducing SSIs to capitalize on their expertise and data sources.

Surveillance for SSI rates – 30 days

For the purpose of *SHN* measurement, we would recommend tracking infections in patients up to thirty days post operatively. The challenge of determining a surgical site infection rate is great. Most infections become apparent after discharge from hospital and in all probability most people with infections do not get readmitted to the hospital where the surgery took place. The sensitivity of reporting from physicians and patients is low. Unless you have resources devoted to the follow up of each patient, infection rates, as determined by standard surveillance, will invariably be an underestimation of the actual rate. In the event

that you have no current processes in place for following infection rates for 30 days, SHN recommends that you continue with the surveillance your facility regularly follows on a consistent basis.

One year follow-up on infection data for implantation surgeries is an expectation for certain provincial data bases (31 – 365 days). SHN does not collect this data from the enrolled teams; as many of the readmitted patients may come from elsewhere or present to the community general practitioners. Ideas that an organization may pursue if there are limited resources for surveillance:

- Some organizations are doing one–month follow up with the GP's and surgeons of discharged patients. This would make the denominator easier as it is the list of patients that had the surgery this month; and the numerator would be those that would come back to the surgeon, GP office or hospital.
- Follow those patients that return to the hospital that performed the initial surgery
- Track "in-hospital" infections only
- Add to discharge summary: "please contact my office (surgeon's) if the patient presents with an infection" (this may capture the superficial infections that present in the GP offices)
- Conducting 30 day follow up surveys/telephone contact for probable infections (not ideal – resource consuming)
- There may be other current existing databases that collect surgical site infection information that you can use as a proxy measure. This was done by the Health Quality Council of Alberta where they looked at physician billing data from multiple sources (please see *Canadian Story: SSI surveillance,* pg 21).

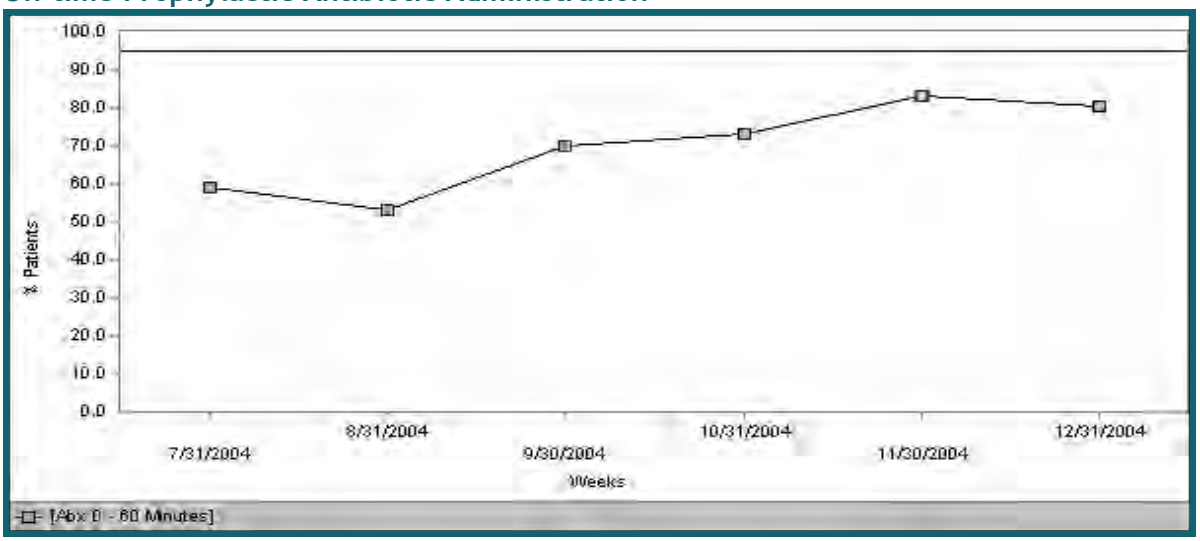
Run Charts

Improvement takes place over time. To determine if improvement has really happened and if it is lasting requires observing patterns over time. Run charts are graphs of data over time and are one of the single most important tools in performance improvement (sample charts attached to Technical Description 1.0 in **Appendix B**).

Using run charts has a variety of benefits:

- They help improvement teams formulate aims by depicting how well (or poorly) a process is performing.
- They help in determining when changes are truly improvements by displaying a pattern of data that you can observe as you make changes.
- As you work on improvement, they provide information about the value of particular changes.

On-time Prophylactic Antibiotic Administration



First Test of Change

Teams may elect to work on any or all of the four care components: antimicrobial coverage, hair removal, perioperative glucose control, and perioperative normothermia. A first test of change should involve a very small sample size (typically one patient) and should be described ahead of time in a Plan-Do-Study-Act format so that the team can easily predict what they think will happen, observe the results, learn from them, and continue to the next test.

Example: Appropriate hair removal. The team decides to test removing razors from one operating room for one surgery. They identify a surgeon who supports the avoidance of razors, and let the surgeon know that the razors will be removed. On their PDSA form, they predict that the surgeon will cope well without razors in the room. They then conduct the test. They note that the surgeon becomes frustrated because s/he wishes to use clippers to remove hair and there are no working clippers available. The team's study of the data indicates that they should repeat this test, after first making sure there is a set of operable clippers available.

Ideally, teams will conduct multiple small tests of change simultaneously across all four components of care. This simultaneous testing usually begins after the first few tests are completed and the team feels comfortable and confident in the process.

Implementation and Spread

For surgical site infection, teams will usually choose to begin their improvement process by working with a "pilot" population. This pilot population may be the hip- and knee-replacement patients, for example, or cardiac operations, or gynaecologic procedures, etc. It is possible to include the universe of surgical patients in the pilot population, if that number is small (fewer than 20 cases per month). We recommend including at least 20 cases per month in the pilot population in order to increase the ability to measure and detect improvement.

In order to maximize the reduction in overall hospital mortality related to surgical site infections, hospitals must spread improvements that start in a pilot population to the universe of surgical populations. Organizations that successfully spread improvements use an organized, structured method in planning and implementing spread across populations, units, or facilities. You can find information about planning, tracking, and optimizing spread at www.ihi.org.

Overcoming Barriers

Teams working on preventing surgical site infection have learned a great deal about barriers to improvement and how to face them. Some common challenges and solutions are:

1. **Lack of support by leadership**

   Solution: Use opinion leaders (physicians) and data. If possible, a business case for the project may help to win leadership support.

2. **Uneven physician acceptance of new practices**

   Solution: Use physician opinion leaders, review the medical literature, and feedback data on a surgeon-specific level. Remember that physicians may fall anywhere on the "Adoption of Innovations" curve. Work first with your early adopters and use their stories to convince the majority.

Appendices

Appendix A: Summary of SHN Recommendations

SSI Prevention Bundle Items	SHN Faculty Recommendation
Prophylactic Antibiotics with Caesarean-Section	Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that prophylactic antibiotic administration be started and completed within 60 minutes of first incision for c-sections instead of after cord-clamping.
Prophylactic Antibiotics with Tourniquet Use	Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that a prophylactic antibiotic infusion be started and completed within 60 minutes for cephalosporins (cefazolin) and infused over 120 minutes for vancomycin and fluoroquinolones prior to application of tourniquet to maximize antibiotic efficacy.
Prophylactic Antibiotic Duration	Based on the evidence, the *Safer Healthcare Now!* faculty recommend that prophylactic antibiotics be completely absorbed within 60 minutes of first incision, and should be repeated for surgeries lasting longer than the half-life of the antibiotic (4 hours for cephalosporins). Antibiotics administered for cardiac, thoracic, orthopaedic and vascular patients should be discontinued within 24 hours of the end of surgery, whereas non-complex and uncomplicated surgeries require no further administration of antibiotics following surgery.
Surgical Antiseptic Skin Preparation	Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommends that the skin should be cleansed before surgery with a chorhexidine-based solution, preferably with no rinse disposable chlorhexidine gluconate impregnated wash cloths. The antiseptic of choice for surgical skin prep should be alcohol based chlorhexidine antiseptic solutions instead of povidone-iodine. Following application of chlorhexidine-alcohol skin prep solution, surgical teams should complete the briefing element of the surgical checklist to allow several minutes for the skin prep to dry prior to first incision. To maximize its efficacy, CHG-alcohol skin prep should not be washed off for at least 6 hours following surgery. In order to prevent a fire hazard, It is imperative that CHG-alcohol skin prep be allowed to air dry for at least 3 minutes, or longer if there is excessive hair insitu. Povidone-iodine should be used as a skin preparation in emergent cases when there is not enough time to allow CHG-alcohol solution to completely dry before incision. Chlorhexidine-alcohol solutions must *not* be used for procedures involving the ear, eye, mouth or neural tissue.

Summary of SHN Recommendations (Cont'd.)

SSI Prevention Bundle Items	SHN Faculty Recommendation
Hair Removal	Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that patients be educated not to shave in the vicinity of the incision for one week preoperatively. No hair removal prior to surgery is optimal. If hair removal is necessary, clippers should be used outside of the OR and within 2 hours of surgery. Do not use razors in the vicinity of the surgical area. Patients should shower after clipping due to increased risk of bacterial contamination of the surgical site.
Perioperative Glucose Control	Based on the evidence, The *Safer Healthcare Now!* SSI faculty recommend that postoperative blood glucose levels be checked on all surgical patients who are diabetic or have risk factors for diabetes. Teams are encouraged to apply glucose control to surgical populations as directed by your local organization.
Perioperative Normothermia	Based on the evidence, the *Safer Healthcare Now!* SSI faculty recommend that measures are taken to ensure that surgical patient core temperature remain between 36.0ºC and 38ºC preoperatively, intraoperatively, and in PACU.

Appendix B: Technical Descriptions and Data Screens

1.0 Percent of Surgical Patients with Timely Prophylactic Antibiotic Administration - Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Percentage of surgical patients whose antibiotic administration were started and completed within 60 minutes prior to surgical incision

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of selected surgical patients whose prophylactic antibiotics were started and completed within 60 minutes prior to surgical incision.

Note: Cases for which either vancomycin or fluoroquinolone were used as prophylactic antimicrobial: These antibiotics need to be started and infused over 120 minutes (to avoid Red Man Syndrome). The infusion needs to be completed within 60 minutes of first incision. Patients who receive these antibiotics within 60 minutes of first incision will count in the numerator.

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: Number of selected surgical patients.

Denominator Exclusions:

- Patients less than 18 years of age
- Patients with an existing infectious process at the same site as the planned surgical procedure or surgeries that are classified under wound class three or four (National Healthcare Safety Network (NHSN), see **Appendix C**)
- Patients who were not given antibiotics at any time from arrival in hospital through the first 24 hours post-operatively

Measurement Period: Monthly

Calculate as: (numerator / denominator); as a percentage

Example of the Calculation:

No. of Hip Arthroplasty pts. with antibiotic infusion started and completed within 60 minutes of incision

---

Total no. of Hip Arthroplasty pts. (in a particular time frame)

X 100 = *Percent of Hip Arthroplasty Patients with Timely Prophylactic Antibiotic Administration*

Comments:

- Determining whether a patient has a pre-existing infectious process at the surgical site or the wound class is generally easy to identify in a chart. Some institutions or regions will collect wound classes electronically.
- If more than one inpatient surgical procedure occurred during the index hospitalization, only the first surgical procedure should be considered for the purposes of this measure.
- For cases involving use of an inflatable cuff or tourniquet to the operative site, the antibiotic should be fully infused prior to inflation of the cuff.
- If you are using a surgical checklist in your OR, consider adding "Antibiotic Prophylaxis: fully infused?" to the Briefing section.
- If you have two antibiotics you count the infusion time of the last antibiotic.

Note: Patients for whom antibiotic start time or incision time is not recorded are counted as not obtaining prophylactic antibiotics on time (i.e., a zero in the numerator).

***Please Note:* The following information on collection strategy and sampling strategy and graphs pertains to all of the measurements contained within **Appendix B**.

COLLECTION STRATEGY:

Safer Healthcare Now! recommends that teams complete concurrent or "real time" data collection as much as possible. The ability to sustain data collection is higher if you integrate data collection into day-to-day work. However, if a team decided to collect their data using retrospective chart reviews then a hospital information system may be able to identify the patients from all discharges by sorting based on these elements. Another alternative is to work with the coding or medical records department to identify the patients at the time of coding and prepare a list or set aside records for review.

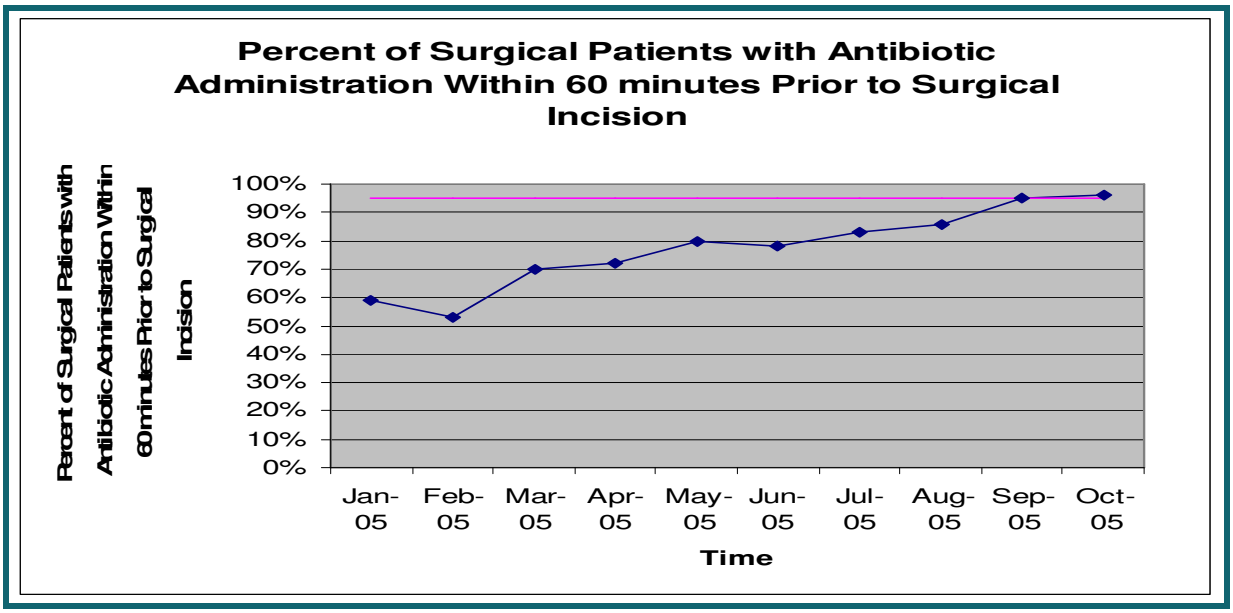
SAMPLING STRATEGY:

Safer Healthcare Now! recommends that you start with one surgical procedure (ie., hip arthroplasties) and spread to other surgical procedures over time.

We suggest that hospitals may decide to collect data using sampling if there is a sufficient volume of cases. The sample size (n) based on the surgical patient population size (N):

Average Monthly Population Size *"N"*	Minimum required sample *"n"*
< 20	No sampling; 100% of population required
20 – 100	20
> 100	15 - 20% of population size

Sample Graph (Run Chart)



1.0 Percentage of Surgical Patients with Timely Prophylactic Antibiotic Administration - Measurement Worksheet

SSI 1 - Percentage of Surgical Patients with Timely Prophylactic Antibiotic Administration - Measurement Worksheet

Prevention of Surgical Site Infections	
Intervention	Reducing Surgical Site Infection
Definition	The percentage of surgical patients with antibiotic administration within 60 minutes prior to surgical incision. Measure from antibiotic start time to surgical start time. If either time is missing, count as NOT obtaining prophylactic antibiotics on time.
Goal	95% or higher
Data Collection Details	
Hospital Name	**Team #**
Health Region	
Patient Sample	*Indicate the surgical procedure you have selected to monitor. Use separate sheets for monitoring individual procedures.*

		2007		2008													
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Calculation of Denominator																		
	Implementation Stage																	
	Collection Method																	
1.1	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedure is performed during a single index hospitalization, include data from the first surgical procedure only.																	
1.2	What is the total number of patients in **# 1.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Rate of timely prophylactic antibiotic administration.*																	
1.3	Subtract the total of **# 1.2** from the total of **# 1.1** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4	What is the total number of patients with an existing infectious process at the same site as the planned surgical procedure – or – surgeries that are classified as class three or four (NHSN) on admission to hospital?																	
1.5	Subtract the total of **# 1.4** from the total of **# 1.3** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.6	What is the total number of patients in **# 1.5** who were not given antibiotics at any time from arrival in hospital through first 24 hours post-operatively?																	
1.7	Subtract the total of **# 1.6** from the total of **# 1.5** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calculation of Numerator																		
1.8	What is the total number of patients in **# 1.7** whose prophylactic antimicrobial consisted of vancomycin or fluorquinolones?																	
1.9	What is the number of patients in **# 1.8** whose antibiotic was infused over 120 minutes and was completed within 60 minutes of surgical incision time?																	
1.10	What is the total number of patients in **# 1.7** who received a prophylactic antibiotic other than vancomycin or fluoroquinolones?																	
1.11	What is the total number of patients in **# 1.10** whose antibiotic was administered within 0 to 60 minutes of surgical incision time?																	
1.12	**Add** the answer to **# 1.9** and **# 1.11** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Calculation																		
1.13	Divide **# 1.12** by **# 1.7**. Multiply by 100.	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
	GOAL:	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
	Comments																	

2.0 Percent of Surgical Patients with Appropriate Prophylactic Antibiotic Discontinuation – Technical Description

Intervention: Reducing Surgical Site Infection

Definition: Percent of surgical patients whose prophylactic antibiotics were discontinued within 24 hours after surgery end time[¥]

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of selected surgical patients whose prophylactic antibiotics were discontinued within 24 hours after surgery end time (e.g. for cefazolin up to three Q8h doses after surgery end time or for vancomycin, up to two Q12h doses after surgery end time).

Single dose prophylaxis is optimal for most non-complex and uncomplicated surgeries (see pg. 12). For patient who require 24 hours of antibiotics, the scheduled doses should start after the surgery has finished (e.g. if administering cefazolin, the first should be administered 8 hours from the surgical end time and the remaining 2 doses administered every 8 hours after that).

(See definition of terms below for which surgeries are included for this measure.)

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: Number of selected surgical patients (See definition of terms below for which surgeries are included for this measure.)

Denominator Exclusions:

- Existing infectious process at the same site as the surgical procedure or surgeries that are classified as wound class 3 or 4[€] (NHSN – **Appendix C**)
- Patients less than 18 years of age
- Patients who were not given antibiotics at any time from arrival to hospital through the first 24 hours post-operatively
- Patients who were diagnosed with and treated for infections within two days after surgery date that cannot be linked to the surgical procedure or an infection may have existed prior to surgery.

Measurement Period: Monthly

Definition of Terms:

- Prophylactic antibiotics: The use of antibiotics before, during, or after a diagnostic, therapeutic, or surgical procedure to prevent infectious complications infection (i.e., not those being given therapeutically for treatment of active infections)[99].

Calculate as: (numerator / denominator); as a percentage

[¥] For cardiothoracic surgery, recent evidence suggests that prophylactic antibiotics could be discontinued **48 hrs** after surgery. Society of Thoracic Surgeons at www.sts.org (last accessed March 18, 2010). Please check with your local antimicrobial prophylaxis recommendations.

[€] Please **see Appendix C** for NHSN definitions

2.0 Percent of Surgical Patients with Appropriate Prophylactic Antibiotic Discontinuation – Measurement Worksheet

SSI 2 - Percentage of Surgical Patients with Appropriate Prophylactic Antibiotic Discontinuation - Measurement Worksheet

Prevention of Surgical Site Infections	
Intervention	Reducing Surgical Site Infection
Definition	The percentage of surgical patients whose prophylactic antibiotic were discontinued within 24 hours after surgery end time. Prophylactic antibiotics are antibiotics given solely for the purpose of prevention of surgical infection (i.e., not those being given therapeutically for treatment of active infections).
Goal	95% or higher
Data Collection Details	
Hospital Name	**Team #**
Health Region	
Patient Sample	*Indicate the surgical procedure you have selected to monitor. Use separate sheets for monitoring individual procedures.*

		2007		2008													
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Calculation of Denominator																		
	Implementation Stage																	
	Collection Method																	
2.1	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization include data from the first surgical procedure only.																	
2.2	What is the total number of patients in **# 2.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of surgical patients with appropriate antibiotic discontinuation.*																	
2.3	Subtract the total of **# 2.2** from the total of **# 2.1** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	What is the total number of patients with an existing infectious process at the same site as the surgical procedure or surgeries that are classified as wound class 3 or 4																	
2.8	What is the total number of patients whose antibiotics are not included in your organization's procedure-specific Antimicrobial Guidelines.																	
2.9	Subtract the total of **# 2.8** from the total of **# 2.7** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.10	What is the total number of patients who developed a postoperative infection less than or equal to 2 days after surgery end date?																	
2.11	Subtract the total of **# 2.10** from the total of **# 2.9** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calculation of Numerator																		
2.12	What is the total number of patients in **# 2.11** whose prophylactic antibiotics were discontinued < 24 hours (1440 minutes) after surgery end time?																	
Final Calculation																		
2.13	Divide **# 2.12** by **#2.11**. Multiply by 100.	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
	GOAL:	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
	Comments																	

3.0 Percent of Clean Surgery Patients with Surgical Infection – Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Rate of infection within 30 days postoperatively in patients undergoing clean surgery (wound classification of 1 or 2 – see Definition of Terms below)

Goal: Reduce baseline by 50%

CALCULATION DETAILS:

Numerator Definition: Number of clean surgery patients having a postoperative wound infection (wound classification 1 or 2)

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: Number of clean surgery patients

Denominator Exclusions:

- Patients who are less than 18 years of age
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases or surgeries that are classified as wound class 3 or 4 (see **Appendix C**)

Measurement Period: Monthly

Definition of Terms:

- ***Class 1 – Clean surgery patient*:** A patient having had a surgery in which the wound is clean, by the NHSN definition: "Uninfected operative wounds in which no inflammation is encountered and respiratory, alimentary, genital, or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non penetrating (blunt) trauma should be included in this category if they meet criteria."
- ***Class 2/Clean – Contaminated Surgery patient*:** "An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered".
- ***Postoperative wound infection*:** A nosocomial infection of the operative site, as defined by National Healthcare Safety Network (NHSN) (see **Appendix C**).

Calculate as: (numerator / denominator); as a percentage

Comments :

Safer Healthcare Now! advises:

- If a region or organization has the resources, SSI rates should be risk adjusted (implying that risk variables be measured on all cases of a procedure whether infection occurs or not). However, we recognize that this is not possible for all organizations.
- SSI rates need to be monitored on a long-term basis for trend, you will see that they have a pattern of normal variation even though prophylaxis compliance increases consistently.
- Work closely with your infection control department on this outcome measure.

3.0 Percentage of Clean Surgery Patients with Surgical Infection – Measurement Worksheet

SSI 3 - Percentage of Clean Surgery Patients with Surgical Infection - Measurement Worksheet																					
Prevention of Surgical Site Infections																					
Intervention	Reducing Surgical Site Infection																				
Definition	The rate of infection in patients undergoing clean surgery (NHSN Class 1 or 2 wound class: Appendix C).																				
Goal	Goal may be set by individual organizations/teams however, IHI recommends a reduction of 50%																				
Data Collection Details																					
Hospital Name													**Team #**								
Health Region																					
Patient Sample	*Indicate the surgical procedure you have selected to monitor. Use separate sheets for monitoring individual procedures.*																				
					2007		**2008**														
					Nov	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Calculation of Denominator																					
	Implementation Stage																				
	Collection Method																				
3.1	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization include data from the first surgical procedure only.																				
3.2	What is the total number of patients in **# 3.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of "clean" surgery patients with surgical infection.*																				
3.3	Subtract the total of **# 3.2** from the total of **# 3.1** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4	What is the total number of patients with an existing infectious process at the same site as surgical procedure or surgeries that are classified as wound class 3 or 4?																				
3.5	Subtract the total of **# 3.4** from the total of **# 3.3** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calculation of Numerator																					
3.6	What is the total number of patients in **# 3.5** (wound classification 1 & 2) who developed a post-operative wound infection/nosocomial infection within 30 days of the surgical procedure as defined in NHSN (see Appendix C)?																				
Final Calculation																					
3.7	Divide **# 3.6** by **# 3.5**. Multiply by 100.	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
	GOAL*:																				
	**The recommended goal for this measure is to reduce the surgical site infection rate by 50%. Using your baseline data, calculate your target infection rat above.*																				
	Comments																				

4.0 Percent of Surgical Patients with Appropriate Hair Removal – Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Percent of selected surgical patients with appropriate surgical site hair removal (Appropriate: no hair removal of surgical site is preferred. Otherwise, hair removal with clipper is appropriate if absolutely necessary. Inappropriate: hair removal of surgical site with razors).

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of selected surgical patients with no surgical site hair removal, or surgical site hair removal with clippers or depilatory

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: Number of selected surgical patients

Denominator Exclusions:

- Patients who are less than 18 years of age
- Burn or transplant patients

Measurement Period: Monthly

Calculate as: (numerator / denominator); as a percentage

4.0 Percentage of Surgical Patients with Appropriate Hair Removal – Measurement Worksheet

1	**SSI 4 - Percentage of Surgical Patients with Appropriate Hair Removal – Measurement Worksheet**																							
2	**Prevention of Surgical Site Infections**																							
3	**Intervention**	Reducing Surgical Site Infection																						
4	**Definition**	The percent of selected surgical patients with appropriate surgical site hair removal. No surgical site hair removal, or surgical site hair removal with clippers or depilatory, is considered appropriate. Shaving is considered inappropriate.																						
5	**Goal**	95% or higher																						
6	**Data Collection Details**																							
7	**Hospital Name**												**Team #**											
8	**Health Region**																							
9	**Patient Sample**	*Indicate the surgical procedure you have selected to monitor. Use separate sheets for monitoring individual procedures.*																						
10																								
11																								
12				**2007**		**2008**																		
13				**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**				
14	**Calculation of Denominator**																							
15		**Implementation Stage**																						
16		**Collection Method**																						
17	**4.1**	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization, include data from the first surgical procedure only.																						
18	**4.2**	What is the total number of patients in **# 4.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of selected surgical patients with appropriate surgical site hair*																						
19	**4.3**	Subtract the total of **# 4.2** from the total of **# 4.1** and enter here.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
20	**4.4**	What is the total number of patients in **# 4.3** who were admitted for treatment of burns or for organ transplantation?																						
21	**4.5**	Subtract the total of **# 4.4** from the total of **# 4.3** and enter here.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
22	**Calculation of Numerator**																							
23	**4.6**	What is the total number of patients in **# 4.5** with no surgical site hair removal, or with hair removal with clippers or depilatory?																						
24	**Final Calculation**																							
25	**4.7**	Divide **# 4.6** by **# 4.5**. Multiply by 100.		#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####			
26		GOAL:		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%			
27		**Comments**																						

5.0 Percent of Surgical Patients (including Major Cardiac) with Controlled Postoperative Serum Glucose – Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Percent of surgical patients (including major cardiac) with controlled postoperative glucose (<10 mmol/L)

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of surgical patients (including major cardiac) with controlled postoperative glucose (<10 mmol/L)

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: All surgical patients

Denominator Exclusions:

- Patients who are less than 18 years of age
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases
- Patients with physician-documented infection prior to surgical procedure
- Burn or transplant patients

Measurement Period: Monthly

Definition of Terms:

- Controlled perioperative glucose: The blood glucose values on postoperative day (POD) one and two drawn closest to 6:00 a.m. (0600)

Calculate as: (numerator / denominator); as a percentage

Comments:

Blood glucose values on both POD 1 and 2 must be below 10 mmol/L for the patient to be included in the numerator; an average glucose value of below 10 mmol/L is not sufficient.

5.0 Percentage of Surgical Patients (including Major Cardiac) with Controlled Postoperative Serum Glucose – Measurement Worksheet

SSI 5 - Percentage of All (including Major Cardiac) Surgical Patients with Controlled Post Operative Serum Glucose - Measurement Worksheet

Prevention of Surgical Site Infections	
Intervention	Reducing Surgical Site Infection
Definition	**Effective April 2010** this measure has been revised in two ways. First, this measure now applies to the percentage of **ALL** surgical patients including major cardiac surgical patients with controlled post-operative glucose. Secondly, the recommended level for post-operative serum glucose hes been changed from 11.0 to **<10** mmol/L. Blood glucose values on both POD 1 and 2 must be below **10** mmol/L for the patient to be included in the numerator; an average glucose value of below 10 mmol/L is not sufficient
Goal	95% or higher
Data Collection Details	
Hospital Name	Team #
Health Region	
Patient Sample	*Indicate the surgical procedure you have selected to monitor. Although the best evidence for glucose control is in the cardiac surgery population there is evidence that controlling post-operative glucose in other surgical procedures is advantageous as well. Please indicate in the space directly below the surgical group you are monitoring and use another worksheet for each separate surgical group e.g. hip and knees, open*

		2007		2008															
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Ap
Calculation of Denominator																			
	Implementation Stage																		
	Collection Method																		
5.1	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization include data from the first surgical procedure only.																		
5.2	What is the total number of patients in # **5.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of selected surgical patients with controlled postoperative serum glucose.*																		
5.3	Subtract the total of # **5.2** from the total of # **5.1** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
~~5.4~~	~~What is the total number of patients in # 5.3 who had principal diagnosis codes suggestive of perioperative infectious disease?~~																		
~~5.5~~	~~Subtract the total of # 5.4 from the total of # 5.3 and enter here.~~	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.6	How many of the total number of patients in # **5.3** who had physician documentation of being treated for an infection prior to the surgical procedure?																		
5.7	Subtract the total of # **5.6** from the total of # **5.3** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.8	What is the total number of patients in # **5.7** who were admitted for treatment of burns or for organ transplantation?																		
5.9	Subtract the total of # **5.8** from the total of # **5.7** and enter here.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calculation of Numerator																			
5.10	What is the total number of patients in # 5.9 with a controlled post-operative glucose level of < 10 mmol/L measured on post-operative day (POD) 1 and 2 at or closest to 0600?																		
Final Calculation																			
5.11	Divide # **5.10** by # **5.9**. Multiply by 100.	####	####	####	####	####	####	####	####	####	####	####	####	####	####	#####	#####	#####	####
	GOAL:	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
	Comments																		

6.0 Percent of Surgical Patients with Postoperative Normothermia – Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Percent of surgical patients with normothermia (36.0 - 38.0 ° C or 96.8 - 100.4 ° F) in post-anesthesia care unit (PACU)

- There can be discrepancy in core temperatures measured by the gold standard methods and the other methods, but overall the thermometers should correlate if used consistently (ie. temporal thermometer generally consistently reads higher and the tympanic thermometer generally reads lower). (Please see pg. 19)

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of surgical patients whose first temperature in PACU were within the range of 36-38 ° C or 96.8-100.4 ° F

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: All surgical patients.

Denominator Exclusions:

- Patients who are less than 18 years of age
- Burn or transplant patients
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases

Measurement Period: Monthly

Definition of Terms:

- Normothermia: Core temperature 36-38 ° C or 96.8-100.4 ° F.

Calculate as: (numerator / denominator); as a percentage

6.0 Percentage of All Surgical Patients with Postoperative Normothermia in PACU - Measurement Worksheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	**SSI 6 - Percentage of All Surgical Patients (including colorectal and open abdominal) with Normothermia in PACU - Measurement Worksheet**																					
2	**Prevention of Surgical Site Infections**																					
3		**Intervention**	Reducing Surgical Site Infection																			
4		**Definition**	The percent of surgical patients with normothermia (36.0° - 38.0°C) in post-anesthesia care unit (PACU). **As of April 2010 this measure should be applied to all patients undergoing surgery regardless of type** (previously colorectal and open abd only).																			
5		**Goal**	95% or higher																			
6		**Data Collection Details**																				
7		**Hospital Name**											**Team #**									
8		**Health Region**																				
9		**Patient Sample**	*Indicate the surgical procedure you have selected to monitor. For the purposes of SHN, only colorectal surgery patients are to be included in this measure.*																			
10																						
11																						
12						**2007**		**2008**															
13						**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
14	**Calculation of Denominator**																					
15			**Implementation Stage**																			
16			**Collection Method**																			
17		**6.1**	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization include data from the first surgical procedure only.																			
18		**6.2**	What is the total number of patients in **# 6.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of selected surgical patients with normothermia.*																			
19		**6.3**	Subtract the total of **# 6.2** from the total of **# 6.1** and enter here.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20		**6.4**	What is the total number of patients in **# 6.3** who had principal diagnosis codes or admission diagnosis suggestive of preoperative infectious disease?																			
21		**6.5**	Subtract the total of **# 6.4** from the total of **# 6.3** and enter here.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22		**6.6**	How many of the total number of patients in **# 6.5** who were admitted for treatment of burns or for organ transplantation?																			
23		**6.7**	Subtract the total of **# 6.6** from the total of **# 6.5** and enter here.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	**Calculation of Numerator**																					
25		**6.8**	What is the total number of patients in **# 6.7** whose first temperature in PACU was within the range of 36.0° - 38.0°C?																			
26	**Final Calculation**																					
27		**6.9**	Divide **# 6.8** by **# 6.7**. Multiply by 100.			#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
28			GOAL:			95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
29			**Comments**																			

7.0 (Optional Measure) Percent of Surgical Patients with Appropriate Selection of Prophylactic Antibiotic – Technical Description

Intervention(s): Reducing Surgical Site Infection

Definition: Percent of surgical patients receiving prophylactic antibiotic according to guidelines issuing bodies[∞]

Goal: 95% or higher

CALCULATION DETAILS:

Numerator Definition: Number of selected surgical patients receiving prophylactic antibiotics consistent with guidelines issuing bodies recommended for their specific surgical procedure. (See definition of terms below for which surgeries are included for this measure.)

Numerator Exclusions: Same as denominator exclusions

Denominator Definition: Number of selected surgical patients. (See definition of terms below for which surgeries are included for this measure.)

Denominator Exclusions:

- Patients less than 18 years of age
- Existing infectious process at the same site as the surgical procedure or surgeries that are classified as wound class 3 or 4[€] (NHSN – see **Appendix C**)
- Patients who were not given antibiotics at any time from arrival in hospital through the first 24 hours post-operatively

Measurement Period: Monthly

Calculate as: (numerator/denominator); as a percentage

[∞] Please consult with your local drugs and therapeutics committee on the selection of guidelines consistent with your locally approved recommendations. Common references are: The Medical Letter on Drugs and Therapeutics[1], American Society of Health-System Pharmacists (ASHP) Therapeutic Guidelines, Canadian *Bugs and Drugs 2006* Antimicrobial Reference, Blondel-Hill & Fryters, www.bugsanddrugs.ca), JCAHO/CMS guidelines, Centres for Disease Control(CDC), Scottish Intercollegiate Guidelines.

[€] Please see **Appendix C** for definitions

7.0 (Optional Measure) Percentage of Surgical Patients with Appropriate Selection of Prophylactic Antibiotic – Measurement Worksheet

1	**SSI 7 - Percentage of Surgical Patients with Appropriate Selection of Prophylactic Antibiotic - Measurement**																					
2	**Prevention of Surgical Site Infections**																					
3	**Intervention**	Reducing Surgical Site Infection																				
4	**Definition**	The percentage of surgical patients receiving prophylactic antibiotic consistent with guidelines issuing bodies.																				
5	**Goal**	95% or higher																				
6	**Data Collection Details**																					
7	**Hospital Name**												**Team #**									
8	**Health Region**																					
9	**Patient Sample**	*Indicate the surgical procedure you have selected to monitor. Use separate sheets for monitoring individual procedures.*																				
10																						
11																						
12				**2007**		**2008**																
13				**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**		
14	**Calculation of Denominator**																					
15		**Implementation Stage**																				
16		**Collection Method**																				
17	**7.1**	What is the total number of patients during this month who had an inpatient surgical procedure of the type indicated above? If more than one surgical procedures are performed during a single index hospitalization include data from the first surgical procedure only																				
18	**7.2**	What is the total number of patients in **# 7.1** whose age was less than 18 yrs on admission to hospital? *Exclude from patient list for calculating Percentage of surgical patients receiving appropriate antibiotic therapy.*																				
19	**7.3**	Subtract the total of **# 7.2** from the total of **# 7.1** and enter here.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20	**7.4**	What is the total number of patients with an existing infectious process at the same site as the surgical procedure or surgeries that are classified as wound class 3 or 4?																				
21	**7.5**	Subtract the total of **# 7.4** from the total of **# 7.3** and enter here.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	**7.6**	What is the total number of patients in **# 7.5** who were not given antibiotics at any time from arrival in hospital through the first 24 hours post-operatively? *Exclude from patient list for calculating Percentage of surgical patients receiving appropriate antibiotic therapy.*																				
23	**7.7**	Subtract the total of **# 7.6** from the total of **# 7.5** and enter here.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	**7.8**	~~What is the total number of patients whose antibiotics are not included in Table 1 (Appropriate Antibiotics)?~~																				
25	**7.9**	~~Subtract the total number of # 7.8 from the total of # 7.7 and enter here.~~																				
26	**Calculation of Numerator**																					
27	**7.10**	What is the total number of patients in **# 7.7** who received prophylactic antibiotics appropriate for their surgery type and allergy status as indicated in the local pharmacy and therapeutics committee?																				
28	**Final Calculation**																					
29	**7.11**	Divide **# 7.10** by **# 7.7**. Multiply by 100.		#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####		
30		GOAL:		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%		
31		**Comments**																				

Appendix C: National Healthcare Safety Network (NHSN) Definition of Wound Classifications**

Class I/Clean	An Uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating (blunt) trauma should be included in this category if they meet the criteria.
Class II/Clean-Contaminate	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
Class III/Contaminated	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered are included in this category.
Class IV/Dirty-Infected	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

** Mangram et al. (1999). Guideline for Prevention of Surgical Site Infection. *Infection Control and Hospital Epidemiology, 20*(4), p. 247-278.http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SSI.pdf

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