Surgical Infection Prevention (SIP) Collaborative Problem Statement

Summary by Qualis Health at **http://www.qualishealth.org/sip.htm**

Americans rely on their healthcare system for the maintenance and improvement of health, which often involves care in the hospital setting. Although most patients believe that the American healthcare system provides the highest quality and safest care in the world, it is estimated that four out of every one hundred hospitalized patients in the United States suffers a serious adverse event, many of which are avoidable. In the Institute of Medicine report To Err is Human it is estimated that between 44,000 and 98,000 deaths per year result from adverse events.[2] In comparison, there are approximately 45,000 deaths yearly from auto accidents.

Sixty-nine percent of adverse events and deaths in healthcare are due to an error in management and thus are potentially preventable. Dr. Lucian Leape and colleagues have described these types of errors, which include diagnostic failures, treatment errors, errors in prevention, and others including communication failure and equipment failure.[3] Some of these errors lead to perioperative infections, a major cause of patient injury, mortality, and healthcare cost. An estimated 2.6 percent of nearly 30 million operations are complicated by surgical site infections (SSIs) each year.

Established in 1970, the CDC's National Nosocomial Infections Surveillance (NNIS) system monitors reported trends in nosocomial infections in participating US acute-care hospitals. According to the NNIS system reports, SSIs are the third most frequently reported nosocomial infection, accounting for 14–16% of all nosocomial infections among hospitalized patients.[4] Surgical site infections are a common complication of care, occurring in 2–5% of patients after clean extra-abdominal operations (e.g., thoracic and orthopedic operations) and in up to 20% of patients undergoing intra-abdominal procedures.[5-10] Among surgical patients, SSIs were the most common nosocomial infection, accounting for 38% of all such infections. When surgical patients with nosocomial SSI died, 77% of the deaths were reported as related to the infection, and the majority (93%) were serious infections involving organs or spaces accessed during the operation.[11] Cruse estimated that an SSI increased a patient's hospital stay by approximately ten days and cost an additional $2,000 in 1980.[12,13] There are more recent studies, including a 1992 analysis by Martone, which corroborate an increase in length of stay and cost (7.3 additional postoperative hospital days and $3,152 in extra charges) in patients with SSIs.[14-16] If a hospital with an annual surgical volume of 10,000 operations could reduce their 300 SSIs by half, this would result in an average annual cost savings of approximately $450,000, based on 1992 cost estimates. Deep SSIs involving organs or spaces are associated with even greater increases in hospital stays and costs.[17,18]

An estimated 40–60% of SSIs are preventable with appropriate use of prophylactic antibiotics.[11, 19-21] Overuse, under use, improper timing, and misuse of antibiotics occurs in 25–50% of operations.[22-26] A large number of hospitalized patients develop infections caused by Clostridium difficile, and 16% of this type of infection in surgical patients can be attributed to inappropriate prophylaxis use alone.[27] Inappropriate use of broad spectrum antibiotics or prolonged courses of prophylactic antibiotics puts all patients at

even greater health risks due to the development of antibiotic-resistant pathogens. In addition to the proper use of prophylactic antibiotics and good surgical technique, other factors under the control of the operative team have been demonstrated to affect significantly the risk of SSI.[11] These other factors include preventing hypothermia during the procedure,[28] maintaining high levels of inspired oxygen,[29] controlling serum glucose within certain limits,[30-32] avoiding shaving the operative site,[33-37] and other basic prevention strategies.[38] All of these preventive measures provide opportunities for improvement in most hospitals.

Although the primary focus of the Collaborative work is SSIs, infections in patients undergoing surgery are not limited to those that involve the surgical site. Other types of infections occurring in patients undergoing surgery include, but are not limited to, infections of centrally inserted venous access lines for perioperative monitoring, urinary tract infections, and pneumonia.

Effective surgical infection prevention and harm reduction therefore require redesigning systems with safety in mind.[39] The fundamental law of improvement is this: every system is perfectly designed to achieve exactly the results it gets. In order to attain a new level of performance in safety, there must be a new system. This applies to all forms of performance—such as selection, timing, and duration of antimicrobial prophylaxis; thermoregulation; oxygen tension; glucose control; hair removal and other basic prevention strategies. Some healthcare organizations have succeeded in creating new and safer systems for SSIs.[40] Major opportunities still exist to reduce the incidence of surgical infections, create safer care for patients requiring surgery and a more satisfactory work environment for healthcare workers, and reduce costs and improve efficiency.

Reducing surgical infections while minimizing antibiotic resistance remains a challenge to many healthcare institutions. Healthcare providers are faced with the additional challenge of trying to integrate new evidence-based infection prevention strategies, such as perioperative glycemic control, into practice. Enlightened management teams, regulatory agencies, health plan providers and purchasers, and medical associations need to provide the support required to create a culture of patient safety in our healthcare systems. With this support, informed, activated hospital teams can be empowered to make key changes to their subsystems (e.g., surgical units) and to incorporate safety considerations into their everyday work.

References

1. Nolan TW. System changes to improve patient safety. *BMJ.* 2000;320:771-773.

2. Institute of Medicine. *To Err is Human.* Washington DC: The National Academy Press, 1999.

3. Leape LL, Lawthers AG, Brennan TA, Johnson WG. Preventing medical injury. *Quality Review Bulletin.* 1993;19:144–149.

4. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. *Clin Microbiol Rev.* 1993;6(4):428–442.

5. Delgado-Rodriguez M, Sillero-Arenas M, Medina-Cuadros M, Martinez-Gallego G. Nosocomial infections in surgical patients: comparison of two measures of intrinsic patient risk. *Infect Control Hosp Epidemiol.* 1997;18:19–23.

6. Horan TC, Culver DH, Gaynes RP, Jarvis WR, Edwards JR, Reid CR. Nosocomial infections in surgical patients in the United States, January 1986-June 1992. National Nosocomial Infections Surveillance (NNIS) System. *Infect Control Hosp Epidemiol.* 1993;14:73–80.

7. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infect Control Hosp Epidemiol.* 1992;13:606–608.

8. Horan TC, Emori TG. Definitions of key terms used in the NNIS System. *Am J Infect Control.* 1997;25:112–116.

9. Wallace WC, Cinat M, Gornick WB, Lekawa ME, Wilson SE. Nosocomial infections in the surgical intensive care unit: a difference between trauma and surgical patients. *Am Surg.* 1999;65:987–990.

10. Scheel O, Stormark M. National prevalence survey on hospital infections in Norway. *J Hosp Infect.* 1999;41:331–335.

11. Mangram AJ, Horan TC, Pearson ML, et al.**:** Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol.* 1999;20:250–278; quiz 279–280.

12. Cruse PJ. Wound infection surveillance. *Rev Infect Dis.* 1981;4(3):734–737.

13. Cruse PJ, Foord R. The epidemiology of wound infection: a 10-year prospective study of 62,939 wounds. *Surg Clin North Am.* 1980;60(1): 27–40.

14. Martone WJ, Jarvis WR, Culver DH, Haley RW. Incidence and nature of endemic and epidemic nosocomial infections. In: Bennett JV, Brachman PS, eds. *Hospital Infections.* 3rd ed. Boston: Little, Brown and Co; 1992. p. 577–96.

15. Boyce JM, Potter-Bynoe G, Dziobek L. Hospital reimbursement patterns among patients with surgical wound infections following open-heart surgery. *Infect Control Hosp Epidemiol.*1990;11(2):89–93.

16. Poulsen KB, Bremmelgaard A, Sorensen AI, Raahave D, Petersen JV. Estimated costs of postoperative wound infections. A case-control study of marginal hospital and social security costs. *Epidemiol Infect.* 1994;113(2): 283–295.

17. Vegas AA, Jodra VM, Garcia ML. Nosocomial infection in surgery wards: a controlled study of increased duration of hospital stays and direct cost of hospitalization. *Eur J Epidemiol.* 1993;9(5):504–510.

18. Albers BA, Patka P, Haarman HJ, Kostense PJ. Cost effectiveness of preventive antibiotic administration for lowering risk of infection by 0.25%. [German]. *Unfallchirurg.* 1994;97(12):625–628.

19. Platt R, Zaleznik DF, Hopkins CC, et al. Perioperative antibiotic prophylaxis for herniorrhaphy and breast surgery. *N Engl J Med.* 1990;322:153–160.

20. Dellinger EP, Gross PA, Barrett TL, et al. Quality standard for antimicrobial prophylaxis in surgical procedures. Infectious Diseases Society of America. *Clin Infect Dis.* 1994;18:422–427.

21. Page CP, Bohnen JMA, Fletcher JR, et al. Antimicrobial prophylaxis for surgical wounds: Guidelines for clinical care. *Arch Surg.* 1993;128:79–88.

22. Gyssens IC, Geerligs IE, Dony JM, et al. Optimising antimicrobial drug use in surgery: an intervention study in a Dutch university hospital. *J Antimicrob Chemother.* 1996;38:1001–1012.

23. Gyssens IC, Geerligs IE, Nannini-Bergman MG, et al. Optimizing the timing of antimicrobial prophylaxis in surgery: an intervention study. *J Antimicrob Chemother.* 1996;38:301–308.

24. Silver A, Eichorn A, Kral J, et al. Timeliness and use of antibiotic prophylaxis in selected inpatient surgical procedures. The Antibiotic Prophylaxis Study Group. *Am J Surg.* 1996;171:548–552.

25. Finkelstein R, Reinhertz G, Embom A Surveillance of the use of antibiotic prophylaxis in surgery. *Isr J Med Sci.* 1996;32:1093–1097.

26. Houck PM, Bratzler DW. Personal communication.

27. Crabtree TD, Pelletier SJ, Gleason TG, Pruett TL, Sawyer RG. Clinical characteristics and antibiotic utilization in surgical patients with Clostridium difficile-associated diarrhea. *Am Surg.* 1999;65:507–511.

28. Kurz A, Sessler DI, Lenhardt R**:** Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group [see comments]. *N Engl J Med.* 1996;334:1209–1215.

29. Greif R, Akca O, Horn EP, et al.**:** Supplemental perioperative oxygen to reduce the incidence of surgical-wound infection. Outcomes Research Group [see comments]. *N Engl J Med.* 2000;342:161–167.

30. Dellinger EP**:** Preventing surgical-site infections: the importance of timing and glucose control. *Infect Control Hosp Epidemiol.* 2001;22:604–606.

31. Latham R, Lancaster AD, Covington JF, et al.**:** The association of diabetes and glucose control with surgical-site infections among cardiothoracic surgery patients. *Infect Control Hosp Epidemiol.* 2001;22:607–612.

32. Furnary AP, Zerr KJ, Grunkemeier GL, Starr A**:** Continuous intravenous insulin infusion reduces the incidence of deep sternal wound infection in diabetic patients after cardiac surgical procedures [see comments]. *Ann Thorac Surg.* 1999;67:352–360; discussion 360–352.

33. Olson MM, MacCallum J, McQuarrie DG**:** Preoperative hair removal with clippers does not increase infection rate in clean surgical wounds. *Surg Gynecol Obstet.* 1986;162:181–182.

34. Horgan MA, Piatt JH, Jr.**:** Shaving of the scalp may increase the rate of infection in CSF shunt surgery. *Pediatr Neurosurg.* 1997;26:180–184.

35. Balthazar ER, Colt JD, Nichols RL**:** Preoperative hair removal: a random prospective study of shaving versus clipping. *South Med J.* 1982;75:799–801.

36. Ko W, Lazenby WD, Zelano JA, et al.**:** Effects of shaving methods and intraoperative irrigation on suppurative mediastinitis after bypass operations. *Annals of Thoracic Surgery.* 1992;53:301–305.

37. Pomposelli JJ, Baxter JK, 3rd, Babineau TJ, et al.**:** Early postoperative glucose control predicts nosocomial infection rate in diabetic patients. *JPEN J Parenter Enteral Nutr.* 1998;22:77–81.

38. *Guideline for Prevention of Surgical Site Infection, 1999.* Available at http://www.cdc.gov/ncidod/hip/ssi/ssi.pdf.

39. Reason J. Human error: models and management. *BMJ.* 2000;320:768–770.

40. Classen DC, Evans RS, Pestotnik SL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N Engl J Med.* 1992; 326:281–286. ty. *BMJ.* 2000;320:771–773.

Recommended Reading

1. Burke JP. Maximizing appropriate antibiotic prophylaxis for surgical patients: an update from LDS Hospital, Salt Lake City. *Clin Infect Dis*. 2001;33(Suppl):78–83.

2. Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N Engl J Med*. 1992;326:281–286.

3. Dellinger EP, Gross PA, Barrett TL, et al. Quality standard for antimicrobial prophylaxis in surgical procedures. The Infectious Diseases Society of America. *Infect Control Hosp Epidemiol*. 1994;15:182–188.

4. Gaynes RP, Culver DH, Horan TC, Edwards JR, Richards C, Tolson JS. Surgical site infection (SSI) rates in the United States, 1992–1998: the National Nosocomial Infections Surveillance System basic SSI risk index. *Clin Infect Dis*. 2001;33(suppl):69–77.

5. Greif R, Akca O, Horn EP, Kurz A, Sessler DI. Supplemental perioperative oxygen to reduce the incidence of surgical- wound infection. Outcomes Research Group. *N Engl J Med*. 2000;342:161–167.

6. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Am J Infect Control*. 1992;20:271–274.

7. Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group. *N Engl J Med*. 1996;334:1209–1215.

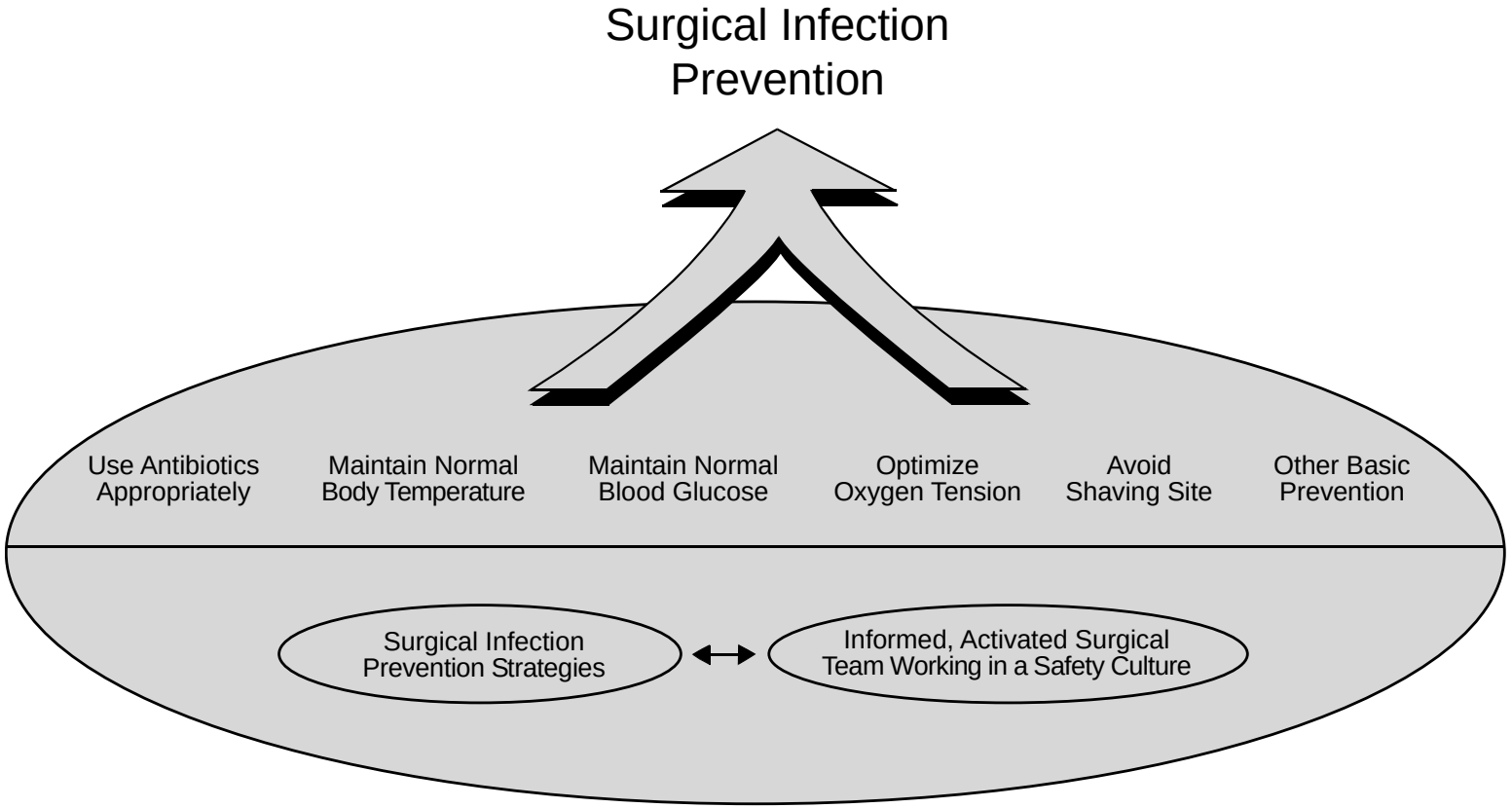
8. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol*. 1999;20:250–278; quiz 279–280.

9. Page CP, Bohnen JM, Fletcher JR, McManus AT, Solomkin JS, Wittmann DH. Antimicrobial prophylaxis for surgical wounds. Guidelines for clinical care. *Arch Surg*. 1993;128:79–88.

10. University of California at San Francisco–Stanford University Evidence-based Practice Center. Chapter 20, Prevention of Surgical Site Infections, of Evidence Report/Technology Assessment No. 43, Making Health Care Safer: A Critical Analysis of Patient Safety Practices, AHRQ Publication No. 01-EO58: Agency for Healthcare Research and Quality. Available at www.ahrq.gov/clinic/ptsafety on March 8, 2002.

Change Package

The change package is a collection of ideas for changing processes of care. The following figure and table present ideas for preventing surgical infection.



Prevention Strategies	Key Changes for Surgical Infection Prevention
Use prophylactic antibiotics appropriately	• Designate responsibility and accountability for preoperative prophylactic antibiotic administration (e.g., preoperative nurse, circulating nurse, anesthesiologist) connected to key point in process • Standardize administration process to occur with commonly performed activity within one hour prior to incision • Through the use of antibiotic standing orders specific to surgical site, administer prophylactic antibiotics according to guidelines based on local consensus • Make agreed upon antibiotics available in the operating room (OR) • Standardize delivery process to ensure timely delivery of preoperative antibiotics to the holding area • Provide visible reminder or checklist to give antibiotics on each case (e.g., brightly colored sticker) • Ensure systematic documentation of antibiotic administration on every patient chart (paper or electronic) • Develop system where antibiotic is hanging at head of patient's bed ready for administration • Design protocols to deliver antibiotic to OR with patient • Educate OR staff regarding the importance and reasoning of antibiotic timing, selection, and duration • Provide feedback on prophylaxis compliance and infection data monthly • Involve pharmacy staff to ensure timing, selection, and duration are maintained
Maintain normothermia perioperatively	• Limit heat loss in patients prior to operative procedure • Standardize use of warming devices (warming blankets, hot air blankets, IV fluid heaters, filter heater hydrator for laparoscopic procedures) to ensure patient temperature >36^{o} C perioperatively • Provide devices and protocol for consistent measurement of patient temperature • Designate responsibility and accountability for thermoregulation • Assure engineering controls allow surgical staff to control room temperature • Provide surgical staff with cooling gear/devices
Maintain glucose control	• Design standardized protocol for intraoperative and postoperative glucose monitoring • Use standardized treatment protocol to maintain serum glucose ≤200 mg/dL

Prevention Strategies	Key Changes for Surgical Infection Prevention
Optimize oxygen tension	• Design protocols to administer supplemental O_2, which is defined as (a) intraoperative FIO_2 >80% in the intubated patient ***or*** a non-rebreathing face mask at >12 L/min fresh gas flow in the non-intubated patient ***and*** (b) postoperative FIO_2 >80% in the intubated patient ***or*** a non-rebreathing face mask at >12 L/min fresh gas flow in the non-intubated patient for 2 hours • Design educational training programs for postoperative staff
Avoid shaving operative site	• Remove all razors from operating room • Perform hair removal when necessary with clippers right before surgery • Establish protocol for when and how to remove hair in affected areas • Provide patient education and materials on appropriate hair removal techniques to prevent shaving at home
Basic prevention strategies* (Based on organizational self-assessment of adherence to practice) *Category IA CDC Recommendations	• Exclude patients with prior infections • Stop patient tobacco use prior to surgery • Apply sterile dressing for 24–48 hr • Shower with antiseptic soap • Provide positive pressure ventilation in OR with at least 15 air changes/hr • Keep OR doors closed • Use sterile instruments • Wear a mask • Cover hair • Prepare skin with appropriate agent • Wear sterile gloves; double-glove • Maintain short nails; remove artificial nails • Handle tissue gently • Ensure that surgeons/staff clean hands with appropriate agents and methods • Delay primary closure for heavily contaminated wounds • Exclude infected surgeons • Use closed suction drains (when used)

Measurement Strategy

The following table lists required and optional measures that teams can select or adapt. Teams can also develop new measures based on the issues that are of most interest and importance to their hospital. There are three types of measures: outcome measures, process measures, and balancing measures. The table below provides definitions of each type of measure. Also provided on page 43 is a sample data collection tool. This tool will also be available electronically on the e-mail list.

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
Outcome Measures (Measures of change [or lack of change] in the well-being of a defined population related to an intervention. Improvement in outcome measures reflects the health status of the patient, whereas process measures reflect the care delivery to the patient. Improvement in outcome measures has a direct effect on mortality and morbidity.)				
O1. Number of surgical cases between surgical site infections (SSIs) ***(Required)***	Number of surgical cases between each SSI	Infections acquired in the hospital by a surgical patient at the surgical site. SSI may be of three types: • superficial incisional • deep incisional • organ or space infection	Create system to capture data prospectively on 100% of patients in the pilot population May require revising run charts continuously	Double number of surgical cases between SSIs

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
Process Measures (What is done to, for, with, or by defined individuals or groups as part of the delivery of services.)				
P1. Percent of surgical cases with on-time prophylactic antibiotic administration ***(Required)***	• N = number of patients with prophylactic antibiotics within one hour prior to surgical incision (see "Exceptions" to the right) • D = number of surgical cases with documented antibiotic administration time and time of surgical incision	• Antibiotic started means administration has begun but is not necessarily completed • Cases in which time of antibiotic administration or time of surgical incision is not documented should be excluded from the numerator and denominator • Exceptions: (1) within two hours if patient receiving vancomycin due to beta-lactam allergy, (2) patients with tourniquets need to have all antibiotic administration completed before the tourniquet is inflated and within one hour prior to surgical incision and (3) patients undergoing C-section should receive the antibiotic as soon as the umbilical cord is clamped	Create system to capture data prospectively on 100% of patients	100% beginning within one hour prior to surgical incision (see "Exceptions" to the left)

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
P1-2. Percent of surgical cases with timing documented ***(Optional)***	• N = number of patients with times documented • D = number of surgical cases receiving prophylactic antibiotics	Proportion of patients receiving a prophylactic antibiotic who have antibiotic administration time and time of surgical incision documented	Create system to capture data prospectively on 100% of patients	100% of patients receiving prophylactic antibiotics
P2. Percent of surgical cases with appropriate selection of prophylactic antibiotic ***(Required)***	• N = number of patients receiving antibiotic consistent with adopted guidelines • D = number of surgical cases	• Proportion of patients given right antibiotic as determined by published guidelines • Organizations will adopt a published guideline (CMS or other) or adapt a published guideline to local circumstances and use this to determine if the correct antibiotic was given to the patient • Note: See back pocket of handbook for CMS recommended guidelines	• Create system to capture data prospectively on 100% of patients • If events very rare, may use the number of cases between inappropriate selection	Achieve 100% compliance with appropriate selection of prophylactic antibiotics
P3. Percent of patients with perioperative glucose control ***(Optional)***	• N = number of surgical patients whose serum glucose was controlled • D = number of surgical patients	Alternate proposed definition is percent of patients with serum glucose ≤200 mg/dL intraoperatively and during the first 48 hours postoperatively	Create system to capture data prospectively on 100% of patients	Achieve 100% compliance with perioperative glucose control (alternatively, ≤200 mg/dL) during the first 48 hours after an operation for the pilot population

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
P4. Percent of surgical patients with perioperative normothermia ***(Optional)***	• N = number of surgical patients with temperature >36 °C • D = number of patients not excluded from normothermic maintenance	• Normothermia occurs when temperature >36 °C • Exclusion: patients for whom hypothermia is deliberately sought for therapeutic reasons (e.g., hypothermic total circulatory arrest)	• Record last intraoperative temperature (alternatively, record temperature upon arrival to PACU) • Create system to capture data prospectively on 100% of patients	100% for those not excluded from normothermic maintenance
P5. Percent of surgical patients provided supplemental O_2 perioperatively ***(Optional)***	• N = number of patients receiving supplemental O_2 perioperatively • D = number of patients meeting inclusion criteria	Supplemental O_2 is defined as (a) intraoperative FIO_2 >80% in the intubated patient ***or*** a non-rebreathing face mask at >12 L/min fresh gas flow in the non-intubated patient ***and*** (b) postoperative FIO_2 >80% in the intubated patient ***or*** a non-rebreathing face mask at >12 L/min fresh gas flow in the non-intubated patient for 2 hours Exclusions: (1) ambulatory patients (not admitted as inpatients) and (2) patients with COPD and evidence for CO_2 retention	• Create system to capture data prospectively on 100% of patients • Teams might want to start with high-risk population	100% surgical patients not excluded

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
P6. Percent of surgical staff who are knowledgeable in surgical infection prevention ***(Optional)***	• N = number of staff who obtain a score of 100% on post-test • D = number of staff surveyed	Resembles a spread measure in that it may be cumulative by month	Use survey after education detailing surgical infection prevention practices	100% of surgical staff knowledgeable in surgical infection prevention
P7. Percent of patients with appropriate hair removal ***(Optional)***	• N = number of surgical patients with hair removed appropriately • D = number of patients requiring hair removal	• Exclusion: patients for whom hair removal is not necessary	• Create system to capture data prospectively on 100% of patients • Define appropriate hair removal for each type of surgery in pilot population (e.g., depilatory may be appropriate, clipping may be appropriate, usually shaving is not appropriate)	Achieve 100% compliance with appropriate hair removal

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
Balancing Measures (Measures that together with the selected process and outcome measures describe a great system of care. These measures may be process or outcome measures, and usually measure some aspect of the system that may inadvertantly be affected by changes in specific areas of the model.)				
B1. Percent of surgical patients who received prophylactic antibiotics whose antibiotics were discontinued within 24 hours after surgery Note: this measure linked to cost and to prevention of resistant strains of bacteria ***(Required)***	• N = number of patients receiving prophylactic antibiotics who had them discontinued within 24 hours • D = number of patients who received prophylactic antibiotics	Discontinued is defined as discontinued within 24 hours of the surgery end time	Create system to capture data prospectively on 100% of patients	100% of surgical patients with prophylactic antibiotics discontinued within 24 hours of the surgery end time
B2. Cost per surgery ***(Optional)***	• N = dollars allocated to surgical accounting codes per month • D = number of surgical cases			No increase in direct costs, or increase in direct cost is less than the cost of SSIs prevented
B3. Volume of surgical workload per month ***(Optional)***	Number of surgical cases per month	Surgery defined as involving an incision and occurring in an operating room		

Measure	Statistic	Definition	Data Collection	Appropriate Collaborative Goals
B4. Incidence of resistant bacterial strains ***(Optional)***	1. N = number of different resistant strains. If the same strain is isolated several times from the same patient, it should only be reported once. If the apparently same strain is isolated from several patients, it should be reported for each patient. D = number of surgical ICU patient days/1000 days 2. N = defined daily dose D = number of surgical ICU patient days/1000 days	1. Number of resistant strains per 1000 patient days; use laboratory determination of resistant strain 2. Defined daily dose of antibiotics per 1000 patient days	Laboratory data	