

Surgical Site Infection (SSI)

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1. Introduction

This VICNISS SSI surveillance module is based on the National Health Safety Network (NHSN) Patient Safety Component Manual, Centers for Disease Control and Prevention (CDC) in the United States¹.

Despite advances in infection control practices including improved operating room ventilation, sterilisation methods, barriers, surgical technique, and availability of antimicrobial prophylaxis, SSIs remain a substantial cause of morbidity and mortality among hospitalised patients^{2,3}.

Surveillance of SSI with feedback of appropriate data to surgeons has been shown to be an important component of strategies to reduce SSI risk^{4,5,6,7}. A successful surveillance program includes the use of epidemiologically sound infection definitions and effective surveillance methods, stratification of SSI rates according to risk factors associated with SSI development, and data feedback^{5,6}.

2. Methodology

This module requires active, patient-based, prospective surveillance of operative procedure-associated infections and the corresponding denominator data by a trained infection control professional (ICP). This means that the ICP shall seek out infections during a patient's stay by screening a variety of data sources, such as laboratory, pharmacy, admission/discharge/transfer, medical imaging, and pathology databases, and patient charts, including history, nurses/physicians notes, temperature charts, etc. Any combination of these methods is acceptable; however, VICNISS criteria for surgical site infection (SSI) must be used.

Due to the potential for poor documentation and the delay in obtaining patient histories from Medical Record (Health Information) offices, retrospective chart review should be used only when patients are discharged before all information can be gathered. To minimise the ICP's data collection burden, others may be trained to collect the denominator data (e.g., OR staff) and to screen data sources for these infections, however the ICP must make the final determination.

Setting

Surveillance can occur with surgical patients in any inpatient/outpatient setting where the selected VICNISS operative procedure(s) are performed.

Requirements

Refer to the [Type 1 VICNISS Performance Indicators](#) and [Type 2 VICNISS Performance Indicators](#) on the VICNISS website for required SSI surveillance activities. For further information also refer to the [VICNISS Type 1 Surveillance Manual \(section 4.1\)](#) and the [VICNISS Type 2 Surveillance Manual \(section 4.3\)](#) on the VICNISS website.

Collect numerator and denominator data on all procedures in the selected procedure group for the duration of the surveillance period.

Definitions

VICNISS Inpatient: is a patient whose date of admission to the healthcare facility and date of discharge are different calendar days.

VICNISS Outpatient: is a patient whose date of admission to the healthcare facility and date of discharge are the same calendar day.

VICNISS Operative Procedure: is a procedure that: 1) is performed on a VICNISS inpatient or outpatient; and 2) takes place during an operation (defined as a single trip to the operating room [OR] where a surgeon makes at least one incision through the skin or mucous membrane, including laparoscopic approach, and closes the incision before the patient leaves the OR); and 3) that is included in the nominated [VICNISS procedure groups](#) (section 4 below).

Note: If the skin incision edges do not meet because of wires or devices or other objects extruding through the incision, the incision is not considered primarily closed and therefore the procedure is not considered an operation. Further any subsequent infection is not considered a surgical site infection.

VICNISS Procedure Group: are combinations of clinically similar operative procedures that allow comparison of SSI rates in groups of patients undergoing similar operative procedures and most groups are identical to those used in the US NHSN system. The SSI rate in each procedure group is stratified by the SSI risk index in order that comparisons can be made between infection rates for each group. Refer to [section 4](#) below, or refer to either the full list of procedure groups and codes relevant to Type 1 participants [Type 1 VICNISS Procedure Groups, ICD10-AM Codes, & CMBS Codes](#), or to the selected list relevant to Type 2 participants [Type 2 VICNISS Procedure Groups, ICD10-AM Codes, & CMBS Codes](#) on the VICNISS website.

Implant: A nonhuman-derived object, material, or tissue that is permanently placed in a patient during a VICNISS operative procedure and is not routinely manipulated for diagnostic or therapeutic purposes. Examples include: porcine or synthetic heart valve, mechanical heart, metal rods, mesh, sternal wires, screws, cements, internal staples, hemoclips, and other devices. Non-absorbable sutures are excluded because ICPs may not easily identify and/or differentiate the soluble nature of suture material used.

VICNISS Surgical Site Infection (SSI): occurs in a VICNISS inpatient or outpatient following an operative procedure and there is no evidence that the infection was present or incubating at the time of hospital admission unless the infection was related to a previous VICNISS patient admission to this hospital and it meets the criteria for either superficial incisional, deep incisional, or organ/space SSI (as defined below).

Criteria for Surgical Site Infections

The criteria for each type of SSI (as defined below) must be met prior to reporting to VICNISS.

Superficial Incisional:

A superficial incisional SSI must meet the following criteria:

- Infection occurs within 30 days after the operative procedure, and
- involves only skin and subcutaneous tissue of the incision, and
- patient has at least one of the following:
 - a. purulent drainage from the superficial incision.
 - b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
 - c. at least one of the following signs or symptoms of infection: pain or tenderness, localised swelling, redness, or heat, and superficial incision is deliberately opened by surgeon, and is culture-positive or not cultured. A culture-negative finding does not meet this criterion.
 - d. diagnosis of superficial incisional SSI by the surgeon or attending physician.

Comments:

- If a CBGB patient has infections at both chest and donor site enter as two separate infections
- Do **not** report a stitch abscess (minimal inflammation and discharge confined to the points of suture penetration) as a SSI.
- Do **not** report a localised stab wound infection as SSI
- If the incisional site infection involves or extends into the fascial and muscle layers, report as a deep incisional SSI.
- Classify infection that involves **both** superficial and deep incisional sites as deep incisional ie report the greatest of the infection types.
- A stoma infection does not meet the SSI criteria as the infection needs to be at the incision site.
- “Cellulitis” by itself does not meet the SSI criteria unless criterion c (above) is met.

Deep Incisional:

A deep incisional SSI must meet the following criteria:

- Infection occurs within 30 days after the operative procedure if no implant is left in place or within 365 days if implant is in place and the infection appears to be related to the operative procedure, and
- involves deep soft tissues (e.g., fascial and muscle layers) of the incision, and
- patient has at least one of the following:
 - a. purulent drainage from the deep incision but not from the organ/space component of the surgical site.
 - b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured and the patient has at least one of the following signs or symptoms: fever (>38°C), or localised pain or tenderness. A culture-negative finding does not meet this criterion.
 - c. an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
 - d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

Comments:

- If a CBGB patient has infections at both the chest and donor sites enter as two separate infection episodes.
- Classify infection that involves both superficial and deep incisional sites as deep incisional.

Organ / Space:

An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. Specific sites are assigned to organ/space SSI to further identify the location of the infection. Listed below are the specific sites that must be used to differentiate organ/space SSI. An example is appendectomy with subsequent subdiaphragmatic abscess, which would be reported as an organ/space SSI at the intraabdominal specific site⁸.

An organ/space SSI must meet the following criterion:

- Infection occurs within 30 days after the operative procedure if no implant is left in place or within 365 days if implant is in place and the infection appears to be related to the operative procedure, and
- infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure, and
- patient has at least one of the following:
 - a. purulent drainage from a drain that is placed through a stab wound into the organ/space.
 - b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.
 - c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
 - d. diagnosis of an organ/space SSI by a surgeon or attending physician.

Comments:

- Occasionally an organ/space infection drains through the incision. Such infection generally does not involve re-operation and is considered a complication of the incision. Therefore, classify it as a deep incisional SSI.
- When there is no drainage through the incision, the SSI remains an organ/space.
- If there is no spontaneous drainage through the incision, but the wound is deliberately opened – remains an organ/space SSI. Note: It does not matter where the wound was deliberately opened, e.g., ward, operating suite.
- Report mediastinitis following cardiac surgery that is accompanied by osteomyelitis as mediastinitis rather than osteomyelitis
- If meningitis and a brain abscess are present together, report infection as intracranial, brain abscess.
- Report CSF shunt infection as an SSI if it occurs ≤ 1 year of placement; if later or after manipulation/access, it is not considered an SSI and is not reportable
- The following are specific sites of an Organ/Space SSI:

▪ Arterial or Venous Infection	▪ Intracranial, Brain Abscess or Dura
▪ Breast Abscess or Mastitis	▪ Joint or Bursa
▪ Disc Space	▪ Mediastinitis
▪ Endocarditis	▪ Meningitis or Ventriculitis
▪ Endometritis	▪ Myocarditis or Pericarditis
▪ GI Tract	▪ Osteomyelitis
▪ Hepatitis	▪ Other Female Reproductive Tract
▪ Intra-abdominal, not specified elsewhere	▪ Spinal Abscess without Meningitis
- Each specific site of organ/space (listed above) have specific criteria which must be met in order to qualify as a VICNISS event. These criteria are in addition to the general criteria for organ/space SSI above, and can be found in the [CDC/NHSN criteria](#) on the VICNISS website.

Denominator Data

The requirements for the SSI Surveillance module are:

- A. One or more VICNISS Surgical Procedure Groups are selected for monitoring surgical patients. ALL of the ICD-10-AM codes in that Procedure Group **must** be included.
- B. For **all** patients having an operative procedure in the selected VICNISS procedure group complete the [Surgical Site Procedure \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form ensuring all the data fields are completed as specified. For further explanation of required data fields see [Instructions for Completion of SSI Data Forms](#) on the VICNISS website. For more information on how to register and obtain access to web forms please see the [Web Based Data Collection Forms \(Web Forms\) User Guide](#) on the VICNISS website.
- C. Caesarean Section (CSEC) procedures require additional risk factor data fields and a procedure specific [Caesarean Section \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form (which includes the additional Caesarean Section fields) must be completed.
- D. If operative procedures in more than one VICNISS surgical procedure group are performed during the same trip to the OR even if performed through the same incision, a [Surgical Site Procedure \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form is to be completed for each operative procedure being monitored. For example, if a CARD and CBGC are done through the same incision, a [Surgical Site Procedure \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form is reported for each.
Exception: If a patient has both a CBGC and CBGB during the same trip to the OR, report only as a CBGB. Only report as a CBGC when there is a chest incision only. CBGB and CBGC are never reported for the same patient for the same trip to the OR. For bilateral procedures see #H below.
- E. If more than one VICNISS operative procedure from the same VICNISS Surgical Procedure Group is performed through the same incision, record only one procedure for that procedure group. For example, if your hospital is performing surveillance for both CBGB and CARD procedure groups, and a patient undergoes an aortocoronary bypass of one coronary vessel (CBGB) and the replacement of both the mitral and tricuspid valves (both CARD) during the same trip to the OR, you would complete a [Surgical Site Procedure \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form for the CBGB and another one for the CARD.
- F. If more than one VICNISS operative procedure group is performed through the same incision, record the combined duration of all procedures, which is the time from skin incision to primary closure on each denominator form.
- G. Each denominator form should include a description/list of all procedures performed during that trip to the operating room.
- H. For bilateral operative procedures (e.g., KPRO, HER), one denominator procedure form is completed. To document duration of the bilateral procedure, indicate the incision start time to end time for the entire procedure if performed concurrently. If performed sequentially and there are two procedure durations submit the longest duration. Record bilateral on the form where indicated ('bilateral/2 incisions').
- I. Laparoscopic hernia repairs are considered one procedure, regardless of the number of hernias that are repaired in that trip to the OR. In most cases there will be only one incision time documented for this procedure. If more than one time is documented, total the durations. In

this situation if more than one of the incisions should become infected only report as a single SSI.

Note: If more than one open (i.e. non-laparoscopic) hernia repair is performed via a separate incision during the same visit to the OR (i.e. two incisions are made to repair two defects, e.g. umbilical and femoral hernia) complete one denominator procedure form. Record two incisions on the form where indicated ('bilateral/2 incisions'). To document duration of the procedure see #H above, same as bilateral procedure.

- J. If a patient goes to the OR more than once during the same admission and another procedure is performed through the same incision within 24 hours of the original operative incision (end time), report only one procedure on the [Surgical Site Procedure \(Denominator\)](#) paper form or [Surgical Site Procedure \(Denominator\)](#) web form, combining the durations for both procedures. For example, a patient has a CBGB lasting 4 hours. He returns to the operating suite 6 hours later to correct a bleeding vessel. The surgeon reopens the initial incision, makes the repairs, and recloses in 1.5 hours. Record the operative procedure as one CBGB and the duration of operation as 5 hours 30 minutes. If the wound class has changed report the higher wound class. If the ASA score has changed, report the higher ASA score.

Numerator Data

ALL patients are monitored for signs of SSI from the date of the VICNISS operative procedure until discharge from the acute hospital. A [Surgical Site Infection \(Numerator\)](#) paper form or [Surgical Site Infection \(Numerator\)](#) web form is completed for each patient found to have an SSI. For further explanation of required data fields see [Instructions for Completion of SSI Data Forms](#) on the VICNISS website. For more information on how to register and obtain access to web forms please see the [Web Based Data Collection Forms \(Web Forms\) User Guide](#) on the VICNISS website.

There must be no evidence that the infection was present or incubating at the time of hospital admission.

- Information used to determine the presence and classification of an infection should be a combination of:
 - Clinical data - derived from direct observation of the infection site or review of information in the patient's chart or other ward or unit records
 - Laboratory results - cultures, antigen or antibody detection tests, or direct visualisation methods.
 - Diagnostic studies - routine x-rays, ultrasound, CT scan, magnetic resonance imaging (MRI), nuclear scans, endoscopic procedures, biopsies, or needle aspiration.
 - A physician's or surgeon's diagnosis of infection - derived from direct observation during a surgical operation, endoscopic examination, diagnostic studies or from clinical judgment unless there is compelling evidence to the contrary.
- If a patient has several VICNISS operative procedures prior to an infection, report the infection as a result of the operation that was performed most closely in time prior to the infection date, unless there is evidence that the infection is associated with a different operation.
- If a procedure from more than one VICNISS operative procedure group was done through a single incision, attempt to determine the procedure that is thought to be associated with the infection. If it is not clear (as is often the case when the infection is a superficial SSI), attribute the infection to the surgery which has the highest risk of infection (see [VICNISS Procedure Infection Hierarchy](#), section 5 below).
- All patients with an SSI (i.e., meets VICNISS SSI criteria) readmitted to the hospital where the surgical procedure was performed must be reported to VICNISS.

- If an SSI (that meets VICNISS criteria) develops post-discharge, however the onset of clinical signs and symptoms were evident in hospital, the infection is reported as during admission, i.e. in hospital.
- If an SSI is identified by another facility (i.e. patient with SSI was admitted to a facility other than the one in which the operation was performed) it is reported as post-discharge.
- Patients who have an implant insitu are to be followed for development of SSI for 365 days from the date of the procedure.

Exclusions:

- SSIs that are **not** included in VICNISS reporting:
 - SSIs that become evident after hospital discharge. These infections will not be included in the VICNISS reported rates **unless** the infection was detected upon readmission to the hospital (see [VICNISS Type 1 Surveillance Manual \(section 2.4.2, Post Discharge Surveillance\)](#) on the VICNISS website.
 - Infections associated with complications or extensions of infections already present on admission, unless a change in pathogen or symptoms strongly suggests the acquisition of a new infection.
 - A patient admitted with an existing SSI from a procedure that was performed elsewhere. In this case VICNISS make the following comments:
 - Communication is encouraged with the hospital where the procedure was performed to notify them of the SSI.
 - VICNISS could facilitate this communication process if requested.
- The following conditions are not infections:
 - **Colonisation**, which means the presence of microorganisms on skin, on mucous membranes, in open wounds, or in excretions or secretions but are not causing adverse clinical signs or symptoms.
 - Inflammation that results from tissue response to injury or stimulation by non-infectious agents, such as the use of chemicals.

3. Data Analyses

The SSI rates per 100 operative procedures are calculated by dividing the number of SSIs by the number of specific operative procedures and multiplying the results by 100. SSIs will be included in the numerator of a rate based on the date of procedure, not the date of event. Rate calculations will be performed separately for the different types of operative procedures and stratified by risk index. Standardized infection ratios are also calculated using indirect standardization or multivariate models.

- Basic SSI Risk Index. The index used in NHSN assigns surgical patients into categories based on the presence of three major risk factors:
 - Operation lasting more than the duration cut point hours, where the duration cut point is the approximate 75th percentile of the duration of surgery in minutes for the operative procedure.
 - Contaminated (Class 3) or Dirty/infected (Class 4) wound class.
 - ASA classification of 3, 4, or 5.

The patient's SSI risk category is simply the number of these factors present at the time of the operation.

For further information see [VICNISS Type 1 Surveillance Manual \(section 3, Interpretation of Surveillance Results\)](#) on the VICNISS website.

4. VICNISS Procedure Groups

Refer to either the full list of procedure groups and codes relevant to Type 1 participants [Type 1 VICNISS Procedure Groups, ICD10-AM Codes, & CMBS Codes](#), or to the selected list relevant to Type 2 participants [Type 2 VICNISS Procedure Groups, ICD10-AM Codes, & CMBS Codes](#) on the VICNISS website.

Code	Operative Procedure	Description
AAA	Abdominal aortic aneurysm repair	Resection of abdominal aorta with anastomosis or replacement
APPY	Appendix surgery	Operation of appendix (not incidental to another procedure)
BRST	Breast surgery	Excision of lesion or tissue of breast including radical, modified or quadrant resection, lumpectomy, incisional biopsy or mammoplasty
CARD	Cardiac surgery	Procedures on the valves or septum of heart; does not include coronary artery bypass graft, surgery on vessels, heart transplantation, or pacemaker implantation
CBGB	Coronary artery bypass graft with both chest and donor site incisions	Chest procedure to perform direct revascularisation of heart; includes obtaining suitable vein from donor site for grafting
CBGC	Coronary artery bypass graft with chest incision only	Chest procedure to perform direct revascularisation of heart using, for example, the internal mammary (thoracic) artery
CEA	Carotid endarterectomy	Endarterectomy on vessels of head and neck (includes carotid artery and jugular vein)
CHOL	Gallbladder surgery	Cholecystectomy and cholecystotomy
COLO	Colon surgery	Incision, resection, or anastomosis of the large intestine; includes large-to-small and small-to-large bowel anastomosis. Includes operations on rectum.
CRAN	Craniotomy	Excision repair, or exploration of the brain or meninges; does not include taps or punctures
CSEC	Caesarean section	Obstetrical delivery by Caesarean section
FUSN	Spinal fusion	Immobilisation of spinal column NOTE: cannot compare this group to NHSN
FPOP	Femoro-popliteal and femoro-tibial bypass grafts	Femoro-popliteal and femoro-tibial bypass grafts NOTE: this procedure differs from NHSN

Code	Operative Procedure	Description
GAST	Gastric surgery	Incision or excision of stomach; includes subtotal or total gastrectomy; does not include vagotomy and fundoplication
HERN	Herniorrhaphy	Repair of inguinal, femoral, umbilical, or anterior abdominal wall hernia; does not include repair of diaphragmatic or hiatal hernia or hernias at other body sites
HPRO	Hip prosthesis	Arthroplasty of hip; includes total, partial and revision arthroplasties; does not include Birmingham hip resurfacing
HYST	Abdominal hysterectomy	Abdominal approach with uterine removal
KPRO	Knee prosthesis	Arthroplasty of knee
LAM	Laminectomy	Exploration or decompression of spinal cord through excision or incision into vertebral structures
RFUSN	Refusion of spine	Refusion of spine
SB	Small bowel surgery	Incision or resection of the small intestine; does not include small-to-large bowel anastomosis
THOR	Thoracic surgery	Noncardiac, nonvascular thoracic surgery; includes pneumonectomy and hiatal hernia repair or diaphragmatic hernia repair (except through abdominal approach
VHYS	Vaginal hysterectomy	Vaginal approach with uterine removal
VSHN	Ventricular shunt	Ventricular shunts operations, including revision and removal of shunt

5. VICNISS Procedure Infection Hierarchy

Principle Operative Procedure Selection Lists. The following lists are derived from the above table, VICNISS Operative Procedure Groups. The operative procedures with the highest risk of surgical site infection are listed before those with a lower risk.

Priority	Code	Abdominal Operations
1	SB	Small bowel surgery
2	COLO	Colorectal surgery
3	GAST	Gastric surgery
4	CSEC	Caesarean section
5	APPY	Appendix surgery
6	HYST	Abdominal hysterectomy
7	VHYS	Vaginal hysterectomy
8	HERN	Hernia repair
9	CHOL	Cholecystectomy
10	AAA	Abdominal aortic aneurysm repair
Priority	Code	Thoracic Operations
1	CBGB	Coronary artery bypass graft and donor
2	CBGC	Coronary artery bypass graft, chest incision only
3	CARD	Cardiac surgery
4	THOR	Thoracic surgery
Priority	Code	Neurosurgical (Spine) Operations
1	RFUSN	Refusion of spine
2	FUSN	Spinal fusion
3	LAM	Laminectomy
Priority	Code	Neurosurgical (Brain) Operations
1	VSHN	Ventricular shunt
2	CRAN	Craniotomy

6. References

1. Centers for Disease Control and Prevention. The National Healthcare Safety Network (NHSN) Manual. Patient Safety Component Protocol. 2011 www.cdc.gov/nhsn/TOC_PSCManual.html.
2. Klevens TG, Edward JR, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Reports* 2007;122:160-166.
3. Emori TG, Gaynes RP. An overview of healthcare-associated infections, including the role of the microbiology laboratory. *Clin Microbiol Rev* 1993;6(4):428-42.
4. Condon RE, Schulte WJ, Malangoni MA, Anderson-Teschendorf MJ. Effectiveness of a surgical wound surveillance program. *Arch Surg* 1983;118:303-7.
5. Society for Healthcare Epidemiology of America, Association for Professionals in Infection Control and Epidemiology, Centers for Disease Control and Prevention, Surgical Infection Society. Consensus paper on the surveillance of surgical wound infections. *Infect Control Hosp Epidemiol* 1992;13(10):599-605.
6. Haley RW, Culver DH, White JW, Morgan WM, Emori TG, Munn VP. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. *Am J Epidemiol* 1985;121:182-205.
7. Centers for Disease Control and Prevention. Guidelines for prevention of surgical site infection, 1999. *Infect Control Hosp Epidemiol*, 1999;20(4):247-278.
8. Centers for Disease Control and Prevention. CDC/NHSN surveillance definition of health-care associated infection and criteria for specific types of infections in the acute care setting. *AJIC* 2008;36:309-32.