



Surgical Site Infection (SSI) Prevention



Basics of Infection Prevention
2-Day Mini-Course
2016

Objectives

- Review the epidemiology of SSI
- Explore causes and mechanisms of SSI
- Describe evidence-based practices for prevention of SSI
- Review SSI surveillance definitions and methods

Epidemiology of SSI

- SSI infection generally occurs within 30 days following surgery
 - Some procedures monitored up to 90 days for SSI
- 1.9% of hospitalized surgical patients acquire SSI
 - 3% die (75% of deaths directly attributable to the SSI)
 - Many result in long term disability
- SSI increases hospital length of stay 7-10 days
 - Cost estimates vary, ~\$30,000 per SSI
 - Most estimates do not account for re-hospitalization, outpatient treatment, post-discharge expenses, quality of life for the patient, or any long term disability costs



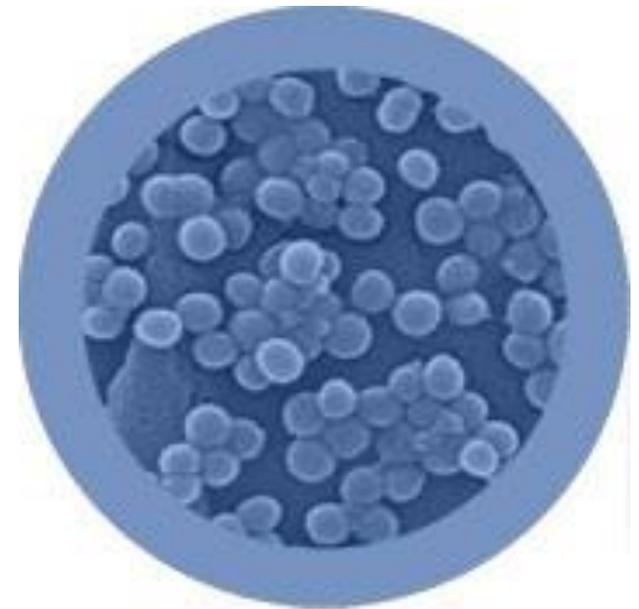
Pathogenesis of SSI

Source of infecting pathogen

- Endogenous
 - Patient Flora
 - Skin
 - GI tract
 - Mucous membranes
 - Seeding from pre-existing sites of infection
- Exogenous
 - Surgical personnel flora
 - Breaks in aseptic techniques
 - Inadequate hand hygiene
 - Contaminated garments
 - Equipment, surgical tools, materials within operative field
 - OR environment, including ventilation

SSI Pathogens

- *Staphylococcus aureus* - 30.0%
- Coagulase-negative staphylococci - 13.7%
- Enterococcus spp - 11.2%
- *Escherichia coli* - 9.6%
- *Pseudomonas aeruginosa* - 5.6%
- Enterobacter spp - 4.2%
- *Klebsiella pneumoniae* - 3.0%
- Candida spp - 2.0%
- *Klebsiella oxytoca* - 0.7%
- *Acinetobacter baumannii* - 0.6%



N=7,025

Jan 2006-Oct 2007

SSI Prevention Objectives

- National HAI Prevention Action Plan
 - SSI reduction of 25% from 2009 baseline
 - 95% adherence rates to Surgical Care Improvement Project (SCIP) process measure
 - 2013 Goal: 25% reduction in admission and readmission SSI (0.75 SIR) – on track to meet target



To review

CDC Prevention Strategies

Core Strategies

High levels of scientific evidence

Demonstrated feasibility

- Should become standard practice

Supplemental Strategies

Some scientific evidence

Variable levels of feasibility

- Consider implementing in addition to Core when infections persist or rates are high

SSI Prevention Strategies: **Core**

Administer antimicrobial prophylaxis in accordance with evidence based standards and guidelines

- Administer within 1-hour prior to incision
(2hr for vancomycin and fluoroquinolones)
- Select appropriate agents on basis of:
 - Surgical procedure
 - Most common SSI pathogens for the procedure
 - Published recommendations
- Discontinue antibiotics within 24hrs after surgery
(48 hours for cardiac)

SSI Prevention Strategies: **Core**

- Identify and treat remote infections – when possible
 - Before elective operation
 - Postpone operation until infection resolved
- Hair removal
 - Do not remove hair at the operative site unless it will interfere with the operation
 - Do not use razors
 - If necessary, remove by clipping or by use of a depilatory agent

SSI Prevention Strategies: **Core**

- Skin Prep
 - Use appropriate antiseptic agent and technique for skin preparation
- Operating Room (OR) Traffic
 - Keep OR doors closed during surgery except as needed for passage of equipment, personnel, and the patient
- Colorectal surgery patients
 - Mechanically prepare the colon (e.g. enemas, cathartic agents)
 - Administer non-absorbable oral antimicrobial agents in divided doses on the day before the operation

SSI Prevention Strategies: **Core**

- Maintain immediate postoperative normothermia
- Surgical Wound Dressing
 - Protect primary closure incisions with sterile dressing for 24-48 hours post-op
- Control blood glucose level during the immediate post-operative period - cardiac
 - Measure blood glucose level at 6 am on post-op day 1 and 2 (procedure day = day 0)
 - Maintain post-op blood glucose level at <200mg/dL

SSI Prevention Strategies: **Supplemental**

- Nasal screen for *Staphylococcus aureus* on patients undergoing
 - elective cardiac surgery, orthopedic, neurosurgery procedures with implants
 - decolonize carriers with mupirocin prior to surgery
- Screen preoperative blood glucose levels and maintain tight glucose control post-op day 1 and 2 in patients undergoing select elective procedures
 - i.e., arthroplasties, spinal fusions, etc.



NOTE: These supplemental strategies are not part of the 1999 HICPAC Guideline for Prevention of Surgical Site Infections

SSI Prevention Strategies: **Supplemental**

- Redose antibiotic at 3 hour intervals in procedures with duration >3 hours
 - *See exceptions to this recommendation in Engelmann, 2007
- Adjust antimicrobial prophylaxis dose for patients who are obese (body mass index >30)
- Use at least 50% fraction of inspired oxygen intraoperatively and immediately postoperatively in select procedure(s)
- Perform surveillance for SSI
- Feedback surgeon-specific infection rates

Updated SSI Prevention Guideline

CDC and HICPAC* updated SSI prevention Guidelines document

- Posted for public comment Jan-Feb 2014
- Introduces several new and updated prevention strategies
- Draft in final review, April 2014
- Waiting for publication



*Healthcare Infection Control Practices Advisory Committee

SSI Surveillance

Requires

- Consistent use of standard methods and definitions for identifying procedures performed and SSI that result
- Capture of sufficient risk factor data for each procedure performed
- Application of risk adjustment methods for meaningful comparisons (i.e., over time within your hospital or to national referent data)

Surgical Procedure Definition

An NHSN operative procedure is a procedure that:

- takes place in an OR (meeting FGI or AIA criteria)
and
- where at least one incision (including laparoscopic approach) is made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure
and
- is included in Table 1: *NHSN Operative Procedure Category Mappings to ICD-9-CM Codes and CPT Codes*



Surgical Closure (New 2015)

- SSI surveillance required for procedures in which there is **BOTH** primary and non-primary surgical closure
- New closure definitions adapted from American College of Surgeons and NSQIP
- **Primary Closure** – closure of the skin level during original surgery, regardless of the presence of wires, wicks, drains, devices or objects extruding through the incision
 - Includes surgeries where skin is closed by some means.
 - If any portion of the incision is closed at the skin level, in any manner, a designation of primary closure should be assigned
- **Non-primary Closure** – closure other than primary



Procedure Risk Factor Data

For EACH procedure

- Gender
- Age
- Surgical wound class
 - clean, clean-contaminated, contaminated, or dirty
- ASA score - as proxy for underlying illness
- Yes/No: Emergency, Trauma, Anesthesia type
- Endoscope (*decreases risk*)
- Duration
- Diabetes status
- Incisional closure type
- Height
- Weight

Duration of Operative Procedure

- Interval between the surgery start time and the surgical procedure finish (PF) time
 - Defined by Association of Anesthesia Clinical Directors (AACD)
 - Reported as hours and minutes
- PF time is when all
 - All instrument and sponge counts are completed and verified correct **AND**
 - all in OR post-op radiographic studies are complete, **AND**
 - all dressings/drains are secured, **AND**
 - physicians/surgeons have completed all procedure-related activities on the patient.

Clean

Operation where no inflammation encountered

Respiratory, alimentary, genital, urinary tracts **not** entered

Operation following non-penetrating (blunt) trauma

Primarily closed with no open drainage

Clean wound classification is not used in denominator data entry for APPY, BILI, CHOL, COLO, REC, SB, and VHYS

Contaminated

Operation following open, fresh, accidental wounds

Operation with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from GI tract

Includes operation where acute, non-purulent inflammation encountered

Surgical Wound Class

Clean - Contaminated

Operation entering respiratory, alimentary, genital, or urinary tracts

No evidence of infection, no major break in technique, no unusual contamination encountered

Operation involving biliary tract, appendix, vagina, and oropharynx

Dirty

Operation involving old traumatic wounds with retained devitalized tissue, **or** existing clinical infection **or** perforated viscera

Definition suggests the organisms causing post-op infection were present before the operation

Identifying SSI

- Surgical Services, surgical units, and OR staff need to assist in SSI surveillance
- Evaluate both clinical and microbiologic findings post-op
 - Can't rely on wound cultures alone to find SSI (!)
- Evaluate surgical patients during hospital stay
 - Rounds on units
 - Pharmacy reports of antimicrobial use
 - Temperature charts / logs
 - Operating room schedule of surgeries/ re-operations
- Monitor surgical patients for re-admission
- Perform post-discharge surveillance
 - Consider using procedure billing codes (ICD-9) to validate data

SSI Surveillance Period

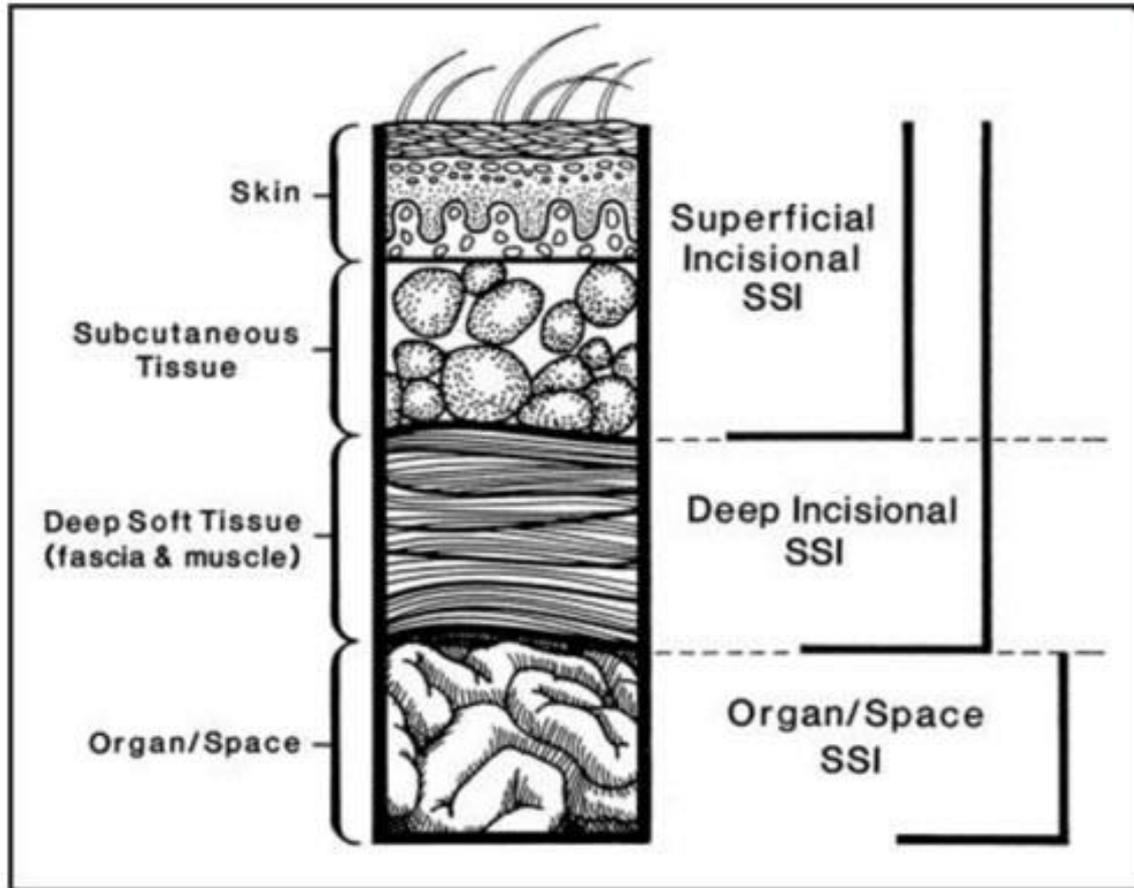
- Post-operative monitoring period determined by NHSN Procedure Category
- 14 NHSN procedure types require 90-day monitoring period

BRST*	CRAN	HPRO	RFUSN
CARD	FUSN	KPRO	VSHN*
CBGB	FX	PACE	
CBGC	HER	PVBY*	

***Not a required
CA-reportable
procedure**

- All other procedure categories monitored for 30 days regardless of presence of an implant
- For all NHSN procedure categories, superficial SSI are monitored for 30 days only

NHSN SSI Surveillance Definition



Categorized
based on depth
of infection

Superficial Incisional SSI

NHSN Surveillance Definition, 2015

- Infection occurs within 30 days after surgical procedure
- AND**
- Involves only skin and subcutaneous tissue of the incision

AND

At least **1** of 4 criteria:

- 1. Purulent drainage from the superficial incision
- 2. Organism isolated from incision culture or fluid (obtained aseptically)
- 3. Diagnosis of superficial SSI by surgeon or attending physician or other designee
- 4. Incision opened by surgeon or designee; culture positive or not cultured

AND

At least **1** of the following:

- Pain or tenderness
- Localized swelling
- Erythema
- Heat



Do not report stitch abscess as an SSI (defined as minimal inflammation and discharge confined to points of suture penetration). Do not report a localized stab wound infection as an SSI. Cellulitis by itself is not an SSI

Deep Incisional SSI

NHSN Surveillance Definition, 2015

- Infection occurs within 30 after surgical procedure (**UNLESS** its one of the 13 procedures followed for **90 days**)

AND

- Involves deep soft tissues of the incision, e.g. fascial & muscle layers

AND

At least **1** of 3 criteria:

- 1. Purulent drainage from deep incision
- 2. Abscess or evidence of infection involving deep incision detected on gross anatomical or histopathologic exam or imaging test
- 3. Deep incision spontaneously dehisces
 -**OR-** opened by surgeon, attending physician or designee and is culture positive or not cultured*

AND

- Patient has at least **1**:
- fever >38°C
 - localized pain, or tenderness

* A culture negative finding does not meet this criteria

Organ/Space SSI

NHSN Surveillance Definition, 2015

- Infection occurs within 30 after surgical procedure (**UNLESS** its one of the 13 procedures followed for **90 days**)

AND

- Involves any part of body deeper than the fascial/muscle layers, opened or manipulated during the surgical procedure

AND

At least **1** of 3 criteria:

- 1. Purulent drainage from drain placed into organ/space
- 2. Organism isolated from an aseptically-obtained culture of fluid or tissue in the organ/space
- 3. Abscess or evidence of infection involving the organ/space that is detected on gross anatomical or by histopathologic or imaging test

AND

- Meets surveillance definition for a **specific NHSN infection site**

Table 4. Specific Sites of an Organ/Space SSI

Code	Site	Code	Site
BONE	Osteomyelitis	LUNG	Other infections of the respiratory tract
BRST	Breast abscess or mastitis	MED	Mediastinitis
CARD	Myocarditis or pericarditis	MEN	Meningitis or ventriculitis
DISC	Disc space	ORAL	Oral cavity (mouth, tongue, or gums)
EAR	Ear, mastoid	OREP	Other infections of the male or female reproductive tract
EMET	Endometritis	PJI	Periprosthetic Joint Infection
ENDO	Endocarditis	SA	Spinal abscess without meningitis
EYE	Eye, or other conjunctivitis	SINU	Sinusitis
GIT	GI Tract	UR	Upper respiratory tract
HEP	Hepatitis	USI	Urinary System Infection
IAB	Intraabdominal, not specified	VASC	Arterial or venous infection
IC	Intracranial, brain abscess or dura	VCUF	Vaginal cuff
JNT	Joint or bursa		

Criteria for these sites can be found in the NHSN Help system (must be logged in to NHSN) for the Surveillance Definitions for Specific Types of Infections chapter.

www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

Infection Present at Time of Surgery (PATOS)

- Evidence of an infection present at the time of an index surgery (i.e. present pre-operatively)
- Required field when reporting an **SSI event**
- Not required when reporting the procedure (i.e. not a field on the denominator form)
- Evidence of infection must be noted/documentated in a pre-operative or intra-operative note

Infection PATOS -2

- Only select PATOS=YES if it applies to the depth of the SSI that is being attributed to the procedure

Examples:

If a patient had evidence of an intra-abdominal infection at the time of surgery and then later returns with an organ space SSI, the PATOS field would be selected as a YES.

If the patient returned with a superficial or deep incisional SSI, the PATOS field would be selected as NO.

Infection PATOS - 3

- The patient does not have to meet the NHSN definition of an SSI at the time of the primary procedure but there must be notation that there is evidence of infection or abscess present at the time of surgery
- SSI reported with PATOS=YES will be excluded from the SSI SIR
 - PATOS-related SSIs will be analyzed separately
- **Refer to the NHSN SSI Protocol for more examples**

SSI Following Multiple Procedures

If >1 operative procedure is done through a single incision and an SSI occurs

- First, attempt to determine the procedure associated with the infection
- If it is not clear, use the NHSN Principal Operative Procedure Selection List to determine the priority procedure for which to attribute the SSI

Example: For abdominal surgeries

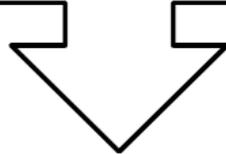
- COLO is higher priority (higher infection risk) than SB
- SB is higher than REC
- REC is higher than GAST



SSI – Event Details

Detected: Required.

Check the box to indicate when/how the SSI was identified.



- A** SSI was identified before the patient was discharged from the facility following the operation
- P** SSI was identified only as part of post-discharge surveillance, including ED visit without readmission. If readmitted, use RF or RO as appropriate.
- RF** SSI was identified due to patient readmission to the facility where the operation was performed.
- RO** SSI was identified due to patient admission to a facility other than where the operation was performed.

*Detected:		<input type="checkbox"/> A (During admission)	<input type="checkbox"/> P (Post-discharge surveillance)	<input type="checkbox"/> RF (Readmission to facility where procedure performed)
		<input type="checkbox"/> RO (Readmission to facility other than where procedure was performed)		
*Secondary Bloodstream Infection: Yes No		**Died: Yes No		SSI Contributed to Death: Yes No
Discharge Date:		*Pathogens Identified: Yes No		*If Yes, specify on pages 2-3.

SSI Prevention Collaboratives and Bundles

- CDC (Center for Disease Control)
http://www.cdc.gov/HAI/pdfs/toolkits/SSI_toolkit021710SIBT_revised.pdf
- IHI (Institute for Healthcare Improvement)
<http://www.ihl.org/Engage/Memberships/MentorHospitalRegistry/Pages/InfectionPreventionSSI.aspx>
- SCIP (Surgical Care Improvement Project)
<https://www.qualitynet.org/dcs/ContentServer?cid=1137346750659&pagename=Medqic/Content/ParentShellTemplate&parentName=TopicCat&c=MQParents>
- WHO (World Health Organization)
www.who.int/patientsafety/safesurgery/en/

Questions?

For more information, please contact any Liaison Team member.

Thank you