Surgical Site Infection Surveillance

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Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Objectives

- Discuss importance of accurate data collection in calculating surgical patient probability of SSI

- Discuss use of ICD-10 diagnostic "flag" codes to improve SSI case finding

- Review SSI surveillance definitions and methods

- Demonstrate how to report SSI data in NHSN

- Discuss NHSN data analysis and feedback to staff

SSI Surveillance Requirements

- Capture sufficient risk factor data for each **procedure**

- Consistently use standard surveillance methods **and** definitions to **identify SSI**

  - For CA hospitals, CDPH developed a standardized SSI surveillance approach using diagnosis codes to flag potential SSI

- Use **risk adjusted** methods that calculate an SSI probability for each surgical event

Surgical Procedure Definition

NHSN operative procedures

- Inpatient = admission and discharge dates on different days

- Take place in an operating room

- Involve at least one incision (including laparoscopic) made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure

- Full definition in the *NHSN Operative Procedure Category Mappings to ICD-10-CM Codes and CPT Codes*

https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

NHSN Patient Safety Manual: Chapter 9

Reporting Procedure Denominator Data

- When multiple procedures codes are performed during the same surgery, each procedure code must be reported separately in the denominator data

Example: if surgery was performed on the colon and the small bowel during the same operation, both COLO and SB procedures should be reported

Procedure Risk Factor Data

Collect these risk factor data for <u>each</u> surgical procedure:

- Gender
- Age
- Height
- Weight
- ASA score - as proxy for underlying illness
- Yes/No: Emergency, Trauma, Anesthesia type

- Scope *(decreases risk)*
- Duration
- Diabetes status
- Incisional closure type
- Surgical wound class
  - clean, clean-contaminated, contaminated, or dirty

Additional risk factors are based on information in the hospital's NHSN Annual survey (e.g., hospital bed size, medical school affiliation, etc.)

<u>Clean</u> Surgical Wound Class

- Operation where **no inflammation** encountered
- Respiratory, alimentary, genital, urinary tracts are **<u>not</u>** entered
  - Among CA reportable procedure types, clean wound class **<u>cannot</u>** be assigned for APPY, BILI, CHOL, COLO, REC, SB and VHYS
- Operation following **non-penetrating** (blunt) trauma
- Primarily closed with **no open drainage**

Wound class designation must be assigned by a person involved in the surgical procedure at the end of the surgery

<u>Clean-Contaminated</u> Surgical Wound Class

- 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**

Wound class designation must be assigned by a person involved in the surgical procedure at the end of the surgery

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<u>Contaminated</u> Surgical Wound Class

- 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** is encountered

Wound class designation must be assigned by a person involved in the surgical procedure at the end of the surgery

<u>Dirty</u> Surgical Wound Class

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

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

Wound class designation must be assigned by a person involved in the surgical procedure at the end of the surgery

NSHN Patient Safety Manual, Chapter 9

Duration of Operative Procedure

- Interval between the surgery start time (incision) and the surgical procedure finish time
  - NHSN definition from the Association of Anesthesia Clinical Directors
  - Reported as hours and minutes

- Procedure finish time:
  - 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

Surgical Closure

- SSI surveillance required for **BOTH** primary and non-primary surgical closure

- 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

    - If any portion of the incision is closed at the skin level, in any manner, primary closure should be assigned

  - **Non-primary Closure** – closure other than primary

NHSN Patient Safety Manual: Chapter 9

SSI Surveillance Period

- Post-operative monitoring period for most NHSN procedures is 30 days
  - Regardless of presence of an implant

- 8 California-required procedure types have 90-day NHSN monitoring period
  - Cardiac (CARD) and Pacemaker (PACE)
  - Coronary artery bypass graft (CBCB and CBGC)
  - Spinal fusion (FUSN)
  - Open reduction of fracture (FX)
  - Hip and knee prosthesis (HPRO and KPRO)

- Surveillance period for superficial SSI is 30 days for all NHSN procedures

Identifying SSI Using Diagnosis Codes

- CDPH-recommended SSI surveillance method

- **Identify specific** ICD-10 diagnosis codes to identify possible SSI

- During 2013 CDPH validation project, 50% unreported (missed) SSI were identified using this method

- Majority of missed SSI occurred prior to hospital discharge

Identifying SSI

Use CDPH diagnosis flag code method for all SSI surveillance

Other methods may include

- Evaluate microbiology findings
  - But **don't rely on wound cultures alone;** will miss $>$50% SSI)
- Monitor surgical patients for readmission
- Involve perioperative and surgical unit staff
- Evaluate surgical patients during hospital stay
- Conduct unit rounds
- Review antimicrobial starts
- Monitor for returns to the OR during SSI surveillance
- Perform post-discharge surveillance
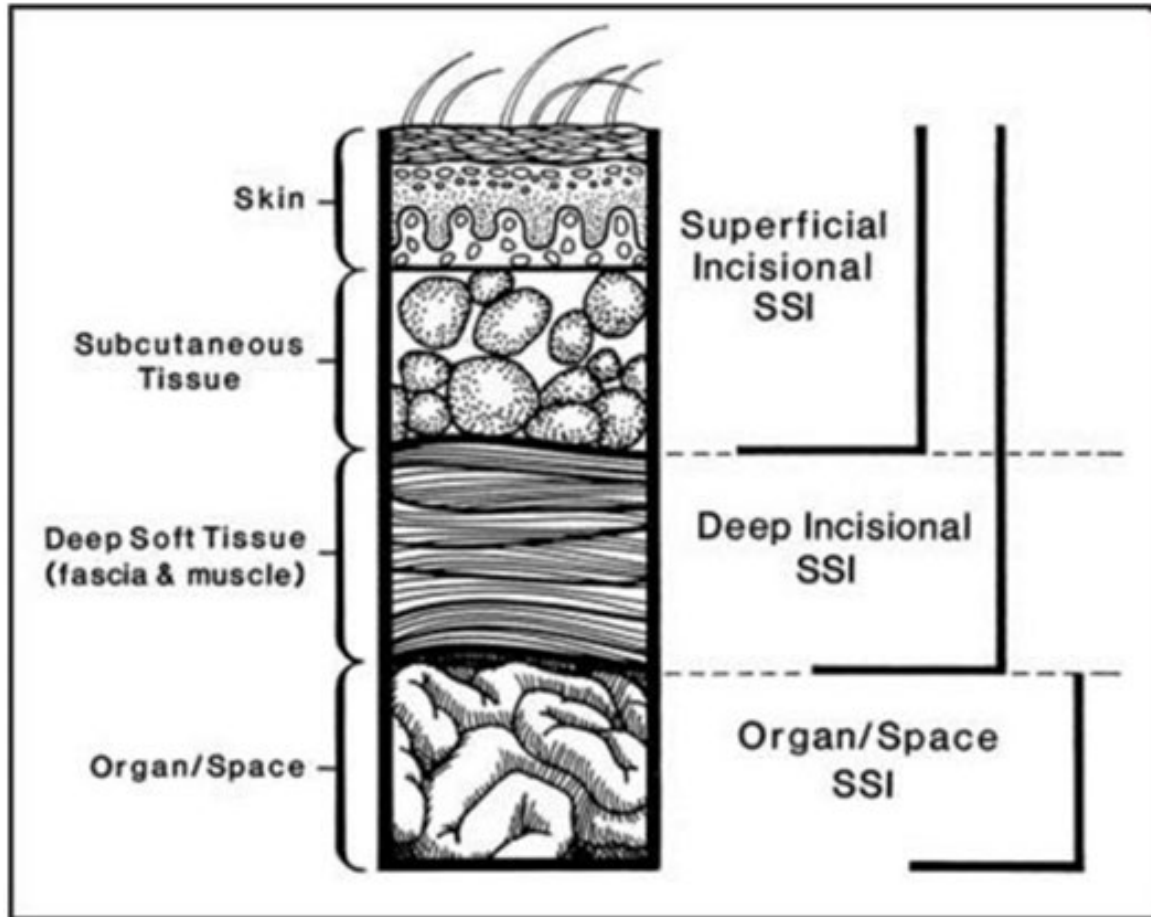
ICD-10 Diagnosis Code SSI Surveillance

- Find ICD-10 diagnosis codes in the post-op period to "flag" patients with <u>possible</u> SSI

- To apply

  1. Create a report of all procedures performed in a specific time period (1 or 2-week period)
  2. Query the billing department for patients on procedure list that have one or more ICD-10 diagnosis flag codes during the 30-day post-op surveillance period (90 days for 8 procedure types)

- Instructions and recommended codes for each procedure type on the CDPH HAI Program website, www.cdph.ca.gov/HAI

https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/UseOfICD-CMDiagnosisCodesToFlagPost-operativePatientsForFurtherEvaluationOfPossibleSSI-.aspx

Use ICD-10 Diagnosis Codes to Identify SSI

Example

- Codes that might indicate SSI following **appendectomy SSI**
  - K63.0   Abscess of intestine
  - K63.2   Fistula of intestine
  - K65.0   Generalized (acute) peritonitis
  - K65.1   Peritoneal abscess
  - K68.19   Other retroperitoneal abscess
  - L03.319   Cellulitis of trunk, unspecified
  - T81.4XXA   Infection following a procedure, initial encounter
  - T81.83XA   Persistent postprocedural fistula, initial encounter

- Full list of CDPH recommended ICD-10 diagnostic "flag" codes at cdph.ca.gov/HAI

NHSN SSI Surveillance Definition

Superficial Incisional SSI

❑ Infection occurs within 30 days after surgical procedure
AND
❑ Involves only skin and subcutaneous tissue of the incision
AND
• Meets 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

Superficial Incisional SSI

- 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.

- Do not report cellulitis by itself, it is not an SSI

Deep Incisional SSI

❑ Infection occurs within 30 days 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

• Meets 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 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

❑ Infection occurs within 30 days 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

❑ Meets 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**

NHSN Patient Safety Manual: Chapter 9, SSI Table 3

Organ/Space SSI Sites

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		

Find specific criteria at:
NHSN PCS Manual: Chapter 17, Surveillance Definitions for Specific Types of Infections   www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

Infection Present at Time of Surgery (PATOS)

- Required field when reporting an SSI <u>event</u>

- Evidence of an infection present at the time of an index surgery

  - Important to assign correct wound class at the end of the index surgery (such as dirty, indicating infection)

- Patient does not have to meet NHSN infection definition at time of primary procedure, but there must be notation of evidence of infection or abscess present at the time of surgery

- Select PATOS='YES' if infection related to SSI type

  - Example: Patient with intra-abdominal infection develops an organ space SSI, PATOS='YES." If patient developed a superficial or deep incisional SSI, PATOS='NO'

- SSI reported with PATOS=YES excluded from SSI SIR calculations

SSI Following Multiple Procedures

- If more than one 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

NHSN Patient Safety Module: Chapter 9, SSI Table 4

SSI Event Details

- **A** – SSI was identified during hospital **admission**, prior to discharge after the operation
- **P** – SSI was identified only by **post discharge** surveillance, including ED visit without readmission. If readmitted, use RF or RO
- RF – SSI was identified due to patient readmission to the **same 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:	☐ A (During admission)	☐ P (Post-discharge surveillance)	☐ RF (Readmission to facility where procedure performed)
☐ 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	

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Reporting an SSI Event to NHSN

NHSN - National Healthcare Safety Network

| NHSN Home |
| Alerts |
| Dashboard |
| Reporting Plan ▶ |
| Patient ▶ |
| Event ▶ |
| Procedure ▶ |
| Summary Data ▶ |
| Import/Export |
| Surveys ▶ |
| Analysis ▶ |
| Users ▶ |
| Facility ▶ |
| Group ▶ |
| Logout |

Add Event

Mandatory fields marked with *

Fields required for record completion marked

Fields required when in Plan marked with >

Add
Find
Incomplete

- Ensure all NHSN definitions are met
- Access NHSN portal
- Click Event/Add
- Add patient information
- Be sure to "link" event to procedure
- Follow prompts to report SSI

Ethnicity: ▼

Race: ☐ American Indian/Alaska Native   ☐ Asian
☐ Black or African American   ☐ Native Hawaiian/Oth
☐ White

Event Information

Event Type *: SSI - Surgical Site Infection ▼

NHSN Procedure Code *: APPY - Appendix surgery ▼

Select button for system used

○ ICD-10 PCS   Outpatient Procedure *: ▼
○ CPT Code

Reporting Procedures to NHSN

NHSN - National Healthcare Safety Network

| NHSN Home |
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| Summary Data ▶ |
| Import/Export |
| Surveys ▶ |
| Analysis ▶ |
| Users ▶ |
| Facility ▶ |
| Group ▶ |
| Logout |

Add Procedure

Mandatory field
Fields required

Patient Inform...

Add
Find
Incomplete

- Refer to NHSN for electronic upload of all procedures
- Access NHSN portal to manually enter or update procedure data

Gender *: M - Male ▼
Ethnicity: ▼
Race: ☐ American Indian/Alaska Native   ☐ Asian
☐ Black or African American   ☐ Native Hawa
☐ White

Procedure Information
NHSN Procedure Code *: APPY - Appendix surgery ▼
Select button for system used
◉ ICD-10 PCS
○ CPT Code
Procedure Date *: [2] Link/Unlink to Event

Procedure Details
Outpatient *: N - No ▼   Duration (Hrs:Mins) *: 1 :
Wound Class *: CC - Clean-contaminated ▼   General Anesthesia *: Y - Yes ▼
ASA Score: 1 - A normal healthy patient
Emergency *: Y - Yes ▼   Trauma *: N - No ▼   Scope *: N - No ▼
Diabetes Mellitus *: Y - Yes ▼   Closure Technique *: PRI - Primary ▼
Surgeon Code: 108 - Colon, Collin ▼
Height *: 5 2 or 1.57 m

NHSN Uses Procedure Data for SSI Risk Adjustment

Table 3c. Predictive Risk Factors from the All SSI Logistic Regression Model, Adults ≥ 18 years of age	
NHSN Operative Procedure	**Risk Factor(s)-All SSI Model, Adults**
AAA	procedure duration
AMP	anesthesia, wound class, hospital bed size*, age, procedure duration
APPY	gender, wound class, hospital bed size*, closure, procedure duration, BMI
AVSD	procedure duration
BILI	gender, emergency, trauma, wound class, hospital bed size*, scope, age, procedure duration
BRST	ASA score, age , procedure duration, BMI
CARD	emergency, medical school affiliation*, age, procedure duration , BMI
CABG	gender, diabetes, trauma, medical school affiliation*, hospital bed size*, age, procedure duration, BMI, age-gender interaction

[The NHSN Standard Infection Ratio: A Guide to SIR](https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf)

(https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf)

SSI Risk Adjustment

- Risk models developed for each NHSN operative procedure
  - Includes only those risk factors found to increase SSI risk for that procedure
- Every patient undergoing a procedure in your hospital has a SSI risk probability calculated by NHSN
- Your hospital's predicted number of SSI is the sum of your surgical patients' risk probabilities

Calculating SSI Incidence

- NHSN applies the risk factors to calculate a probability of each procedure resulting in SSI

- The sum of the probabilities from all patients that had the procedure in your hospital is the "predicted" number of SSI

- To calculate incidence, NHSN compares SSI your hospital identified (observed) to the predicted number of SSI

$$SIR = \frac{\text{Observed SSI}}{\text{Predicted SSI}}$$

NHSN Analysis

- Use SSI data to create charts and graphs to show progress
  - Create in NHSN or Export to Excel for further analysis
- Present results to your surgical team, surgical units, infection control committee, and leadership
- Present surgeon's individual infection SIR
- Celebrate successes and focus on areas to improve

You must analyze your data to review progress!

NHSN SSI Analysis Reports

To create a report

- Access NHSN portal
- Click Analysis/Reports, (remember to generate a data set first)
- Click PA Module/SSI
- Choose report you want to run

NHSN SSI SIR Report

Summary Yr	Procedure Count	infCountAdultCmpx	numPredAdultCmpx	Complex AR Model SIR	Complex AR Model SIR p-value	Complex AR Model 95% Confidence Interval
2015	3623	42	25.848	1.625	0.0034	1.186, 2.176
2016	3466	32	25.013	1.279	0.1723	0.890, 1.784

SIR for Facility

National Healthcare Safety Network
SIR for Adult Complex AR SSI Data by Procedure (2015 Baseline) - Overall, by ProcCode
As of: October 6, 2017 at 4:50 PM
Date Range: BS2_SIR_ADULTCMPXSSIPROC summaryYr 2015 to 2016

Procedure Code	Summary Yr	Procedure Count	infCountAdultCmpx	numPredAdultCmpx	Complex AR Model SIR	Complex AR Model SIR p-value	Complex AR Model 95% Confidence Interval
AAA	2015	11	0	0.075	.		
AAA	2016	10	0	0.068	.		
AMP	2015	181	0	0.674	.		
AMP	2016	146	0	0.453	.		
APPY	2015	177	4	1.255	3.189	0.0479	1.013, 7.691
APPY	2016	162	2	1.068	1.872	0.3825	0.314, 6.186
COLO	2015	118	6	3.358	1.787	0.1792	0.724, 3.716
COLO	2016	126	4	3.887	1.029	0.8931	0.327, 2.482
CRAN	2015	143	4	1.707	2.344	0.1242	0.745, 5.653
CRAN	2016	113	2	1.321	1.514	0.5285	0.254, 5.001
CSEC	2015	840	0	2.286	0.000	0.1017	, 1.311
CSEC	2016	837	1	2.477	0.404	0.3762	0.020, 1.991
FUSN	2015	100	2	1.178	1.698	0.4452	0.285, 5.609

SIR by Procedure

SSI Surveillance Summary

- Consistent use of standard surveillance methods and SSI definitions are essential for accurate case finding

- Capturing complete and accurate data for each procedure is necessary to calculate each patients probability for SSI

- Use of ICD-10 diagnostic "flag" codes will improve case finding

- Analysis and feedback of SSI data is necessary to review progress in SSI reduction

References and Resources

- Anderson DJ, Podgorny K, Berríos-Torres SI, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol*. 2014;35:605-27 http://www.jstor.org/stable/10.1086/676022

- Centers for Disease Control and Prevention (CDC) http://www.cdc.gov/HAI/pdfs/toolkits/SSI_toolkit021710SIBT_revised.pdf

- CDC and HICPAC Recommendations for Prevention of SSI, 2017, http://jamanetwork.com/journals/jamasurgery/fullarticle

- Institute for Healthcare Improvement (IHI) http://www.ihi.org/Engage/Memberships/MentorHospitalRegistry/Pages/InfectionPreventionSSI.aspx

- Surgical Care Improvement Project (SCIP) https://www.qualitynet.org/dcs/ContentServer?cid=1137346750659&pagename=Medqic/Content/ParentShellTemplate&parentName=TopicCat&c=MQParents

- World Health Organization (WHO), www.who.int/patientsafety/safesurgery/en/

Questions?

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