Applied Epidemiology in Health Care Settings and the Community

Supplement: Health care-associated Infection Surveillance: An Educational Series of Case Studies Using the National Healthcare Safety Network Definitions

Issue Highlights:

Rationale for accuracy and consistency in applying standardized definitions for surveillance of health care–associated infections
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MAJOR ARTICLE

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CONTINUING EDUCATION

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Major article

Rationale for accuracy and consistency in applying standardized definitions for surveillance of health care–associated infections

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As legislative mandates for disclosure of data on health care–associated infections (HAIs) to the public escalate, with both economic and reputational implications for hospitals, the development of a valid national surveillance system has become imperative. Recent studies have identified interinstitutional variability of surveillance techniques. These inconsistencies affect the validity of publicly reported HAI data, which has as a primary goal the advancement of patient safety through the reduction of HAIs. The continued funding of state validation studies, the expansion of qualitative research to further assess interrater bias, the endorsement of educational materials to assist infection preventionists with application of National Healthcare Safety Network criteria, and the development of automated surveillance methods are all necessary to ensure a national HAI surveillance system that can be used for public reporting.

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A systematic surveillance methodology has been an essential function of infection prevention programs since the mid-20th century, when hospital-based clinicians and Centers for Disease Control and Prevention (CDC) epidemiologists began to apply a public health model for prevention and control of health care–associated infections (HAIs).1 Consistent with the mission of current programs, the primary goal of early infection control programs was the reduction of HAIs, and valid and reliable detection of these infections was recognized as a critical element of an effective prevention program. The introduction of active, prospective surveillance into hospitals allowed for identification of endemic infection rate increases, recognition of adverse trends, and assessment of performance improvement initiatives. As legislative mandates for disclosure of HAI rates to the public escalate, with both economic and reputation risks for hospitals, the development of a valid national surveillance system has become imperative.

BACKGROUND

In the 1970s, the CDC established a voluntary surveillance system, the National Nosocomial Infection Surveillance (NNIS) system, to provide hospitals with standardized definitions for HAI case finding and the ability to submit monthly data. The reports generated from these data provided essential information about the changing patterns of HAIs and allowed hospitals using the CDC methods to externally benchmark their HAI rates to the aggregated NNIS data. In addition, the CDC funded the Study on the Efficacy of Nosocomial Infection Control (SENIC),2 a scientific assessment of the efficacy of infection control programs. The SENIC data indicated that hospitals with infection surveillance, prevention, and control programs had significantly lower rates of HAIs compared with hospitals without such programs, and a subsequent mandate from the Joint Commission on Accreditation of Hospitals served as a catalyst for programmatic support.

Once the field of infection control was acknowledged as a profession, infection control practitioners and hospital epidemiologists formed professional societies now known as the Association for Professionals in Infection Control and Epidemiology (APIC) and the Society for Healthcare Epidemiology of America (SHEA). The recommendations for training of APIC and SHEA professionals highlighted the importance of surveillance for HAIs. A consensus panel established by SHEA to define the essential activities of infection control and epidemiology in hospitals cited HAI surveillance as the most important data management activity.3 The panel stated in a category I recommendation for surveillance that the process should incorporate standardized definitions of numerators and denominators, identification and description of data sources and data collection personnel, and selection of appropriate
measurement techniques. An additional category recommendation emphasized the need for appropriate data analysis to monitor and improve HAI outcomes.

In the 1990s, as requirements for external reporting of HAI rates increased, health care facilities were asked to move beyond local surveillance with internal benchmarking and begin to benchmark their rates to those in other similar institutions. As external benchmarking using the NNIS HAI aggregate database expanded, the accuracy of data on infections in intensive care unit patients reported by 9 participating NNIS hospitals was evaluated. Emori et al. found sensitivity for prospectively identified infections ranging from 30% to 85%, with the highest sensitivity associated with bloodstream infections, and specificity of at least 97.7% for all infection types analyzed. They concluded that the estimates of sensitivity indicated that hospitals were underreporting some infections. Although that study did not evaluate the hospitals’ surveillance methodologies, the authors surmised that this underreporting was related to inadequate case finding by the surveillance personnel. They emphasized that to ensure the integrity of data, the task of surveillance must include (1) scientifically based and unambiguous criteria for each infection site, (2) clearly defined populations at risk, (3) consistent application of criteria by trained data collectors, (4) relevant and accurate data in the patient medical records, and (5) efficient and sensitive case finding methods. Based on the results of that study, the NNIS proposed clarification and revision of the infection criteria, as well as improvements in the training of NNIS participants.

**CALL FOR PUBLIC REPORTING**

With the publication of the Institute of Medicine’s report “To Err is Human,” which drew attention to HAIs as “preventable harms” and led to increased media coverage of the scope of the HAI problem, the call for mandated public reporting was sound. Consumer advocacy groups, legislative bodies, and accreditation organizations became driving forces behind public reporting. The proponents of heightened transparency of HAI rates argued that quality of care would improve as hospitals became focused on reducing infections. In response to legislation requiring disclosure of HAI rates enacted in 4 states (Illinois, Florida, Missouri, and Pennsylvania), with more to follow, a guidance document on public reporting of HAIs was developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC). The HICPAC guidance document contains no recommendation for or against mandatory public reporting of HAI rates, citing a lack of data to guide such a recommendation. The HICPAC document notes that despite the “patients’ right to know” and the improvement in health care quality that would result from HAI reductions, there remain a lack of reliable data due to potential institutional variability in surveillance methodologies. Instead, the document details specific process and outcome measures for states considering public reporting mandates and emphasizes the use of established public health surveillance methods and a phase-in period to permit ongoing evaluation of data validity.

Currently, 32 states have passed legislation requiring the public reporting of one or more HAIs. As of January 2012, 28 states and the District of Columbia use or plan to use the NHSN for the HAI reporting mandates. Federal policymakers were stimulated to take action, with Congress mandating that the Center for Medicare and Medicaid Services (CMS) financially penalize hospitals in which patients developed “potentially preventable” HAIs. Through the Affordable Care Act Value-Based Purchasing Program, CMS is now requiring national public reporting of central line–associated bloodstream infections (CLABSI), catheter-associated urinary tract infections, and surgical site infections (SSIs) for 2 operative procedure categories.

ASSESSING ACCURACY OF HAI DATA

In 2009, an American Journal of Infection Control commentary by Perla et al. from the Institute for Healthcare Improvement addressed the challenge of having consistent, well-defined, and continuous methods in place to assess the reliability and validity of publicly reported HAI data. The authors acknowledged the importance of standardizing case definitions to guide the judgment of data collectors, but questioned operational methodology. They proposed the development of a standardized data quality and management system to identify problems with interpretation of case definitions and to improve the accuracy of data reported by the NNIS hospitals. They concluded that “the harder you look, the more you find” speaks to the surveillance bias occurring whenever an outcome is diagnosed more frequently in a group that is more closely monitored. A study by Lin et al. for the CDC Prevention Epicenter Program found 3-fold higher rates of CLABSI with the use of a computerized algorithm compared with prospective surveillance performed by IPs. The authors identified significant variation in the applicability of the CDC standard infection criteria and definitions across medical centers, highlighting the potential fallibility of traditional IP surveillance methods that may use partially subjective clinical criteria. In both of the foregoing studies, the authors speculated that institutional differences in clinical culturing practice, quality of medical documentation, and resource application affect the completeness and accuracy of surveillance. They concluded that consistently applied objective criteria for defining CLABSI and standardization of case-finding methods would enhance the validity and reliability of this metric for inter-hospital comparisons.

EFFORTS TO IMPROVE DATA RELIABILITY

The CDC’s publication of state-specific summaries of CLABSI data reported to the NHSN over 2 sequential 6-month periods in 2009 revealed standardized infection ratios below 1.0 nationally and in most states with CLABSI reporting mandates, suggesting highly effective prevention efforts. Of the 18 states included in the report, only 6 had conducted validation assessments by auditing medical records. Although some states secured state funding, the American Recovery and Reinvestment Act of 2009 allowed the CDC to fund HAI data validation in many other states. The validation findings from 3 of these states (Connecticut, Maryland, and Tennessee) revealed issues with sensitivity and misinterpretation of the case definition criteria. Based on an initial pilot validation study that identified an overall sensitivity of 78%, the Tennessee Department of Health initiated facility-level automated data quality checks of CLABSI and SSI data reported to the NHSN. Quality reports were disseminated on a monthly basis to NHSN facility administrators identifying missing information and nonsensical data (eg, number of device-days exceeding the number of patient-days in
the month). A substantial improvement in error-free reports, was observed as well as improved communication between the department and reporting facilities. Importantly, these reports identified that facilities using electronic data sources to capture device-days frequently had inflated denominators, resulting in underestimated CLABSI rates. In addition to state validation projects, the CMS plans to validate the data reported through the NHSN to the Hospital Inpatient Quality Reporting Program. Through these state and federal efforts, issues with application of definition criteria and HAI case finding, as well as denominator capture, can be identified to improve standardization of surveillance practices.

Recognizing the variability of IP surveillance practices as well as the subjectivity that may be introduced in the use of surveillance definitions, the CDC is working with epidemiologists, information technology specialists, and clinicians to develop automated, algorithmic approaches to surveillance. Hota et al detailed their experience with the development of electronic surveillance for CLABSI at 4 hospitals, and concluded that a standard approach to rule development and rate validation is needed to eliminate variability among institutions.

The NHSN has made continual improvements in the system to ensure the integrity of NHSN data and provide infection prevention staff with real-time data reports. The Internet-based application does not allow the saving of incomplete records and has built-in quality checks to ensure that criteria are met and that nonsensical data are not submitted. In addition, the application detects and displays, for correction or confirmation, missing denominator data and missing HAI event data. To facilitate the recognition of adverse data trends, NHSN provides facility-specific data along with comparative data in analysis tables that are immediately available and include P values, confidence intervals, and percentile rankings. The feedback of data in this format allows infection prevention staff to target prevention efforts.

Other efforts undertaken by the NHSN to define and operationalize surveillance best practices include holding training sessions for IPs at national meetings; providing consultative services to assist with difficult cases; convening collaborative working groups to review and revise the definitions of ventilator-associated pneumonia, CLABSI, and SSI to ensure clinical credibility; developing Web-based training modules, and offering intensive 2-day training sessions on surveillance methodology and application of infection definitions. In addition, the HAI Studies Project, which continues with this supplement, is a collaboration between the American Journal of Infection Control and NHSN. The findings of this project, which are based on voluntary participation by IPs responding to clinical case scenarios, are presented in the article by Wright et al in this supplement.

SUMMARY

The public reporting of quality of care outcome measures has become an inherent component of the national patient safety movement. HAI rates, which are based almost exclusively on the manual surveillance conducted by IPs using NHSN definitions, are considered important measures for reporting. The findings from recent studies examining the institutional variation in performance of CLABSI surveillance, as well as the results of several statewide CLABSI validation assessments, have identified differences in the application of surveillance definitions and in case finding techniques. Efforts to improve data reliability include CDC funding support of automated infection detection processes and state validation efforts, continual improvements in the NHSN application, and intensive educational offerings for IPs performing surveillance.

The series of case studies that follows, which represent complex clinical scenarios encountered daily by IPs, were developed to foster learning of NHSN surveillance rules and the correct application of definition criteria. The continued funding of state validation studies, the expansion of qualitative research to further assess interrater bias, the promotion of educational efforts to assist IPs with the application of NHSN criteria, and the development of automated surveillance methods are all necessary to ensure a valid national HAI surveillance system that can be used for public reporting.

References

Continuing education

An American Journal of Infection Control and National Healthcare Safety Network data quality collaboration: A supplement of new case studies

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NHSN
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The rationale for the case study series is presented, along with results of the first 5 American Journal of Infection Control—National Healthcare Safety Network case studies. Although the respondents were correct in their assessments more often than not, opportunities for improvement remain. Ten new case studies with questions are provided. Participants are provided with instructions on how to submit responses for continuing education credit through the Centers for Disease Control and Prevention. Answers with referenced explanations will be provided immediately to those who seek continuing education credit and at a later date via the online journal for those who do not.

This supplement is a continuation of that case series. It includes an overview of the rationale for accuracy and consistently applied standardized definitions for HAI surveillance and participant results from the first 5 case studies, 4 of which were presented at the 2011 National Conference for the Association for Professionals in Infection Control and Epidemiology. Importantly, this supplement provides the reader with an opportunity to attain continuing education credits (CEUs) for their participation. Instructions for CEU application are provided in a separate section as well as at the end of the case studies.

This project serves 3 purposes for IPs regardless of their NHSN participation:

1. To present challenging case scenarios that will provide rationale and clarity in the use of the NHSN surveillance definitions.
2. To provide an opportunity for personal competency assessment as well as for assessment of consistency between IPs within a facility.
3. To provide an additional means of training IPs and an opportunity for them to earn CEUs for their efforts.

PRELIMINARY FINDINGS FROM THE CASE STUDIES

In the first 5 case studies, a total of 3,574 participants answered the questions and received the correct answers through the online assessment tool. Of the 12,441 answers received, 7,979 were
correct, for a total correct response rate of 64.1%. The case studies, participants, and areas of difficulty are summarized in Table 1.

Some common misinterpretations of case definition criteria emerged from these early case studies. One particular area of difficulty involved not recognizing concurrent infections (e.g., a central line–associated bloodstream infection [CLABSI] and a catheter-associated urinary tract infection [CAUTI]) caused by different organisms as independent events. Another issue identified was the misperception that an invasive device had to be in place for some minimum amount of time before the device could be associated with an infection.

Selected demographic variables were optional self-reported fields in case studies 2–4, with a response rate of 77.4%. More than 91% of the respondents were IPs, reflecting the primary intended audience for the case studies. Participants from the 22 states and District of Columbia in which mandatory reporting was required before 2011 were 6% more likely to respond correctly (correctly) will be located in the Transcript and Certificate section of your record.

Methods of Participation

CEUs for this activity are available only through the CDC Training and Continuing Education Online system. Opportunities for continuing education and online evaluation are available until September 30, 2012. Please follow these instructions:

- Have a printed copy of the case studies with you before going to the online submission.
- Review the case studies and complete the test questions and evaluation at the end of the course.
- Access the CDC Training and Continuing Education Online Web site at http://www.cdc.gov/tceonline/. If you have not previously registered as a participant, click on New Participant to create a user ID and password; otherwise, click on Participant Login and login.

To complete online evaluation only (not submitting for CEUs):

- Access the CDC Training and Continuing Education Online Web site at http://www.cdc.gov/tceonline/. If you have not previously registered as a participant, click on New Participant to create a user ID and password; otherwise, click on Participant Login and login.
- Once logged on to the Web site, you will be on the Participant Services page. Click on Search and Register. Use either search method to locate the course (SS1795) and click on View.
- Click on the course title. The course information page will come up. Scroll down to Register Here. Click on the type of CE credit/contact hours that you would like to receive and then Submit. Three demographic questions will come up. Complete the questions and then Submit.
- If you have already completed the course, you may choose to go directly to the evaluation. Complete the evaluation and Submit.
- Complete the posttest. A passing grade is 80%.
- A record of your course completion and your CE certificate (if you completed the test questions and answered at least 80% correctly) will be located in the Transcript and Certificate section of your record.
- If you do not score at least 80%, you will have one opportunity to retake the test.

If you have any questions or problems, contact CDC/ATSDR Training and Continuing Education Online by telephone at 1-800-417-7246 or e-mail at ce@cdc.gov.

Continuing Nursing Education for Nurses

The CDC is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center’s Commission on Accreditation. This activity provides 3.8 contact hours.
The CDC has been approved as an authorized provider by the International Association for Continuing Education and Training (IACET), 1760 Old Meadow Road, Suite 500, McLean, VA 22102. The CDC is authorized by IACET to offer 0.4 ANSI/IACET CEU for this program.

CASE STUDY 1

A 60-year-old female from a local extended-care facility (ECF) underwent a laparoscopic hysterectomy on February 10. At the end of the procedure, the surgeon extended the incision for a hand-assist and removed the uterus via this abdominal incision. Because of concerns about the possibility of infection, the surgeon did not close the incision, leaving large gaps between sutures where the wound edges did not meet. Postoperatively, the patient was admitted to the intensive care unit (ICU) because of hemodynamic instability. A surveillance culture of her nares was performed on admission to the ICU and was reported as positive for methicillin-resistant Staphylococcus aureus (MRSA) on postoperative day 2. On February 13, the patient was discharged back to the ECF.

On February 17, 7 days after surgery, the surgeon was called to the ECF to evaluate the patient. At this time, the patient had a fever of 39.0°C, and her wound was red, painful, and slightly fluctuant along a 2 cm portion of the incision. The surgeon's notes indicate that she incised and drained the area of several milliliters of purulent material, and that the involved area extended into the fascia. Wound cultures grew MRSA, and the patient was started on antibiotics, but no mention of infection was found in the dictation.

1. Which of the following is the correct way to report this patient's operative procedure category to the NHSN?
   a. Vaginal hysterectomy (VHYS)
   b. Abdominal hysterectomy (HYST)
   c. Neither a nor b; this is not an NHSN operative procedure
   d. Both a and b

2. Does this patient have an HAI attributable to the hospital? If so, what type(s)?
   a. Yes, the patient has skin and soft tissue infection of the deep soft tissues (SST-ST).
   b. Yes, the patient has a deep incisional SSI of the primary incision (SSI-DIP).
   c. No, the patient has an HAI attributable to the ECF.

Additional or revised details

In an alternate scenario, suppose that instead of leaving the large gaps between the sutures, the surgeon closed the primary incision completely before the patient left the operating room (OR).

3. Given this revised scenario, which of the following is the correct way to report this patient's operative procedure category and use of laparoscope to the NHSN?
   a. Abdominal hysterectomy; endoscope: no
   b. Abdominal hysterectomy; endoscope: yes
   c. Vaginal hysterectomy; endoscope: no
   d. Vaginal hysterectomy; endoscope: yes

4. In light of the revised scenario in which the incision is completely closed during the procedure, does this patient have an HAI attributable to the hospital? If so, what type?
   a. Yes, the patient has an SST-ST.
   b. Yes, the patient has an SSI-DIP.
   c. No, the patient has an HAI attributable to the ECF.

5. If a patient who had a primarily closed laparoscopic abdominal hysterectomy develops infection in 2 of 3 laparoscopic incisions, how many incisional SSIs should be reported to the NHSN?
   a. Three
   b. Two
   c. One
   d. None

CASE STUDY 2

On April 7, a 65-year-old female was admitted with congestive heart failure from a long-term acute care facility where she was undergoing rehabilitation. Her past medical history included morbid obesity, hypertension, diabetes, and obstructive sleep apnea. Because of deteriorating respiratory status in the emergency room, the patient was intubated and placed on a ventilator. Chest X-ray revealed pulmonary edema. She was taken emergently to the cardiac catheterization laboratory, where left and right heart catheterization was performed. A right internal jugular (IJ) catheter was placed to monitor pulmonary wedge pressures and to infuse fluids and medications, and an indwelling urinary catheter was inserted. She was then transferred to the coronary care unit.

On April 8, the patient was afebrile and normotensive, and demonstrated improving ventilatory status after aggressive diuresis. Rales were still present bilaterally in the lung bases on auscultation, with one fingerbreadth of jugular venous distension noted on the left side of the neck. The right IJ catheter was dry with an intact dressing. A pressure dressing was in place over the cardiac catheterization site in the right groin. The admission rectal swab screen was positive for vancomycin-resistant enterococcus (VRE). The patient was placed on Contact Precautions.

On April 9, the patient had a low-grade fever of 37.5°C. She was being weaned from the ventilator. Chest X-ray revealed atelectasis in the right lower lobe, with small pleural effusions bilaterally and resolution of pulmonary edema. The nursing notes reported clear yellow urine with adequate output. After the pressure dressing in the right groin was removed, slight redness of the site was documented. The right IJ catheter site showed no signs of inflammation through the transparent dressing.

On April 10, the patient was successfully extubated, and the IJ catheter was removed. Her activity was increased to walking with assistance. During transfer from the bed, the patient complained of pain in the right groin. Examination of the site revealed increased redness with swelling and purulent drainage. The patient's temperature was 38.3°C, and a fever workup was initiated. Blood, urine, and groin drainage cultures were sent for laboratory analysis, and empiric antibiotic therapy was started.

On April 11, blood cultures were reported as growing gram-positive cocci in chains, and Gram's stain of the groin drainage showed moderate polymorphonuclear cells with many gram-positive cocci. The groin tenderness and redness had improved.

On April 12, the following laboratory results were available:

- Urine: no growth
- Blood: Enterococcus faecium in 2 of 2 bottles, sensitive to vancomycin (vancomycin-sensitive enterococcus [VSE])
- Groin wound drainage: E. faecium, resistant to vancomycin (vancomycin-resistant enterococcus [VRE])

1. Does this patient have an HAI? If so, what type(s)?
   a. Yes, the patient has a SKIN infection with a secondary bloodstream infection (BSI) with E. faecium VRE.
   b. No, these organisms are colonizers. The patient's fever is related to pulmonary atelectasis.
c. Yes, the patient has a SKIN infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).

d. Yes, the patient has a soft tissue (ST) infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).

**Additional or revised details**

Consider the following change in the scenario. By April 11, the swelling and tenderness in the patient’s right groin site had progressed, her temperature had increased to 40.1°C, and her peripheral WBC count had risen to 20,000 cells/mm². Consultation with an infectious disease specialist raised the suspicion that the infection had progressed into deeper tissue and led to a recommendation for surgical debridement. During the procedure in the OR, the fascial layer was found to be grossly infected.

On September 17 reoperation for bleeding, the surgeon placed a Penrose drain, and a CLABSI with *E. faecium* (VSE). The patient was returned to the OR for repair of splenic vein laceration (International Classification of Diseases Revision 9, Clinical Modification [ICD-9-CM] code 39.32) through the previous incision (see ICD-9-CM Procedure Code Mapping to NHSN Operative Procedure Categories at http://www.cdc.gov/nhsn/library.html). The previous incision was reopened, and a small splenic vein laceration was detected and repaired. The surgeon noted that the anastomosis was intact with no evidence of a leak. The patient tolerated the procedure well and was readmitted to the SIMC. The right IJ catheter and urinary catheter remained in place.

In the late afternoon of September 19, the patient’s vital signs were stable, his urinary output was adequate, his hemoglobin and hematocrit had stabilized, bowel sounds were present, and his diet had progressed to clear liquids. His right IJ catheter and urinary catheter were removed, and he was moved to a surgical floor.

On the morning of September 21, the patient’s abdominal incision was slightly red, warm to the touch, and slightly swollen. He complained of pain at the site while ambulating. Physical examination revealed a small amount of purulent drainage on the dressing. His temperature was 38.4°C. The surgeon opened the skin and subcutaneous layers of the incision and obtained a specimen for culture. Blood and urine cultures were obtained as well. Empiric therapy with vancomycin and piperacillin/tazobactam was started.

On September 22, the blood culture grew *Enterobacter* spp, and Gram’s stain of the wound drainage demonstrated few polymorphonuclear cells and moderate gram-negative rods. The wound remained slightly reddened with minimal drainage, and the patient had a low-grade fever.

On September 23, the following laboratory results were available:

- Urine: >10,000 CFU/mL of *Escherichia coli*; urinalysis negative for WBCs, leukocyte esterase, and nitrites
- Blood: *Enterobacter cloacae* in 2 of 2 bottles
- Incisional drainage: *E. cloacae*

1. Does this patient have an HAI? If so, what type(s)?
   a. Yes, the patient has a BSI with *E. cloacae*, with a secondary superficial incisional primary (SIP) SSI.
   b. Yes, the patient has an SIP-SSI due to *E. cloacae*, with a secondary BSI.
   c. Yes, the patient has a symptomatic urinary tract infection (SUTI) with *E. coli* and an SIP-SSI due to *E. cloacae*, with a secondary BSI.

2. To which operative procedure code is the SSI attributed?
   a. COLO (colon surgery)
   b. OTH (spleenic vein laceration repair)

**Additional or revised details**

Consider some changes to the scenario. During the September 17 reoperation for bleeding, the surgeon placed a Penrose drain, which exited through the incision, preventing primary closure of the wound.

3. What is your assessment of the subsequent infection now?
   a. The patient has a BSI with *E. cloacae*, with a secondary SIP-SSI.
   b. The patient has a SUTI with *E. coli* and a skin and soft tissue infection at the skin-specific site (SST-SKIN) due to *E. cloacae*, with a secondary BSI.
c. The patient has a SIP-SSI due to *E. cloacae*, with a secondary BSI.

d. The patient has an SST-SKIN due to *E. cloacae*, with a secondary BSI.

### CASE STUDY 4

A 29-year-old woman was admitted to the hospital on April 6 in labor at 39 weeks’ gestation. Twelve hours after her membranes spontaneously ruptured, and after 15 hours of difficult labor, a cesarean section (C-section) was performed for failure to progress and fetal cardiac decelerations.

On April 7, the patient was ambulating up and down the hallway and was taking clear liquids by mouth with no problems. She was afebrile and had a moderate amount of bloody drainage from her vagina. Her peripheral IV was maintained at a keep open rate, and her abdominal surgical dressing remained in place.

In the evening of April 8, the patient was tolerating a full liquid diet, but had begun to run a low-grade fever (maximum of 37.6°C). She was not yet lactating, although she continued to try to nurse her baby every 2–3 hours. The nursing staff felt that her low-grade fever might be related to her lack of milk production. Her nipples were reddened and sore, and she was applying lanolin cream as directed. She was ambulating, and her lungs were clear. Her IV had been converted to a heparin lock. Her abdominal dressing had been removed, and the incision had been washed during morning care. The incision appeared clean.

Continuing the scenario, on April 9, the patient complained of mild abdominal pain and received acetaminophen with codeine, with good results. She was tolerating a full liquid diet, and although she had not yet lactated, she continued to try to nurse her baby. Her temperature in the morning was 38.2°C. Her newborn was awake and responsive with patient-controlled pain management.

The patient was transferred to the ICU in stable condition. At 18:00, he was awake and responsive with patient-controlled pain management and a temperature of 37.5°C.

1. At the end of this case, what would you expect the surgical wound class to be?
   a. Clean
   b. Clean-contaminated
   c. Contaminated
   d. Dirty/infected

2. What was the duration of the operative procedure?
   a. 2 hours, 36 minutes
   b. 2 hours, 25 minutes
   c. 2 hours, 45 minutes
   d. More information is needed to make a determination.

### Additional or revised details

Continuing the scenario, at 03:15 on March 9, the patient complained of severe pain in the area proximal to the primary trocar insertion site. He had a temperature of 38.6°C. The resident ordered a complete blood count, blood and urine cultures, and an abdominal computed tomography (CT) scan. The CT scan, performed at 03:50, revealed free fluid proximal to the large intestine. The patient reported that the pain had increased and had spread across his abdomen. By 04:00, his temperature had reached 40°C, and he was emergently returned to the OR. An exploratory laparotomy performed at the site of the primary incision revealed gross spillage from a perforated large intestine. The tissues were inflamed, and small amounts of pus were seen. The abdomen was washed out, and the perforation was repaired. Once the incision was closed, the patient was returned to the ICU. The blood culture grew *Bacteroides fragilis* at 72 hours after the specimen was collected. The patient remained in the hospital until March 15, when he was discharged to home to complete a 2-week course of ertapenem, with plans for follow-up abdominal CT scan at the completion of therapy.

3. Does this patient have an HAI? If so, what type(s)?
   a. No; the large intestine was perforated during the initial operation, and thus any subsequent infection is considered a surgical complication, not an HAI.
   b. Yes, the patient has an SST at the intra-abdominal specific site (SSI-IAB).
   c. No, peritoneal fluid was not cultured, and so no HAI criteria were met.
   d. Yes, the patient has a deep incisional primary SSI (DIP-SSI).

4. If there is an HAI, what was the date of infection?
   a. March 8
   b. March 9
   c. There is no HAI.

5. Assuming that the perforated large intestine is due to the introduction of the trocar during the primary procedure,
should the wound class for the March 8 operative procedure be changed, and if so, to what?
  a. No, it should not be changed.
  b. Yes, it should be changed to clean-contaminated, and the procedure performed on March 9 should be considered contaminated.
  c. Yes, both the March 8 and March 9 procedures should be considered contaminated.
  d. Yes, it should be changed to contaminated. The March 9 procedure is considered dirty/infected.

CASE STUDY 6

On February 18, a 68-year-old woman was brought to the OR from the emergency department (ED). She had been found unresponsive on the floor of her home. She remained unresponsive and had a large hematoma in the right occipital region of her skull. Her Glasgow Coma Scale score was 6. Brain CT scan revealed a large right subarachnoid fluid collection. In the OR, craniotomy and evacuation of hemorrhage were performed. The patient was subsequently admitted to the neurosurgical ICU on a ventilator, with a left subclavian central line and a Foley catheter draining clear amber urine. Chest x-ray after intubation showed that her lungs were clear bilaterally. The patient’s past medical history, as provided by the family, was positive for chronic obstructive pulmonary disease, coronary artery disease, and pulmonary embolism. Admission medications included atorvastatin calcium, albuterol, and daily low-dose aspirin therapy.

On February 19, the patient was still being ventilated and had a nonproductive cough. Her lung sounds were diminished bilaterally. She was afebrile. Her vital signs were within normal limits, and she remained unresponsive to all but painful stimuli.

On February 20, the patient’s neurologic status remained unchanged, and she was still on the ventilator, and had not tolerated efforts to decrease the ventilator settings. She remained afebrile, and her nonproductive cough persisted. Chest x-ray showed atelectasis in both lung bases.

On February 23, the patient remained catheterized and intubated and at initial ventilator settings. The patient began to produce a small amount of cream-colored phlegm with coughing and required intermittent endotracheal suctioning. Scattered rhonchi were present bilaterally. Chest x-ray showed continued atelectasis bilaterally. Her maximum temperature was 37.7°C. She was responsive to pain only. Her Foley catheter continued to drain clear yellow urine. Plans were made to perform tracheostomy on February 25 if she could not be weaned from the ventilator.

On the morning of February 24, the patient had a fever of 38.1°C. Her respiratory and urinary status remained unchanged, and blood, tracheal aspirate, and urine cultures were obtained. The patient reported no pain with palpation of her suprapubic area or costovertebral angle.

By midday on February 26, the patient had a temperature of 38.3°C. Her chest x-ray remained unchanged. The following laboratory results were available:

- Tracheal aspirate: No organisms by Gram’s stain; no growth in culture.
- Blood: Gram’s stain positive for gram-positive cocci; culture positive for Enterococcus faecalis.
- Urine: Gram’s stain positive for gram-positive cocci and gram-negative rods; culture positive for E. faecalis >100,000 CFU/mL and Klebsiella pneumoniae 50,000 CFU/mL.

1. Does this patient have an HAI? If so, what type(s)?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has a catheter-associated asymptomatic urinary tract infection (CA-SUTI) with a secondary BSI.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

Additional or revised details

Consider this altered scenario. The patient was afebrile, but because of a WBC count of 18,000 cells/mm³ and episodes of hypotension requiring the use of vasopressors, the same cultures were collected at the same times as in the original scenario. Laboratory results also were the same as in the original scenario:

- Tracheal aspirate: No organisms by Gram’s stain; no growth in culture.
- Blood: Gram’s stain positive for gram-positive cocci; culture positive for Enterococcus faecalis.
- Urine: Gram’s stain positive for gram-positive cocci and gram-negative rods; culture positive for E. faecalis >100,000 CFU/mL and Klebsiella pneumoniae 50,000 CFU/mL.

2. Does this patient now have an HAI? If so, what type?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has an asymptomatic bacteremic urinary tract infection (ABUTI) that is catheter-associated.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

Additional or revised details

In this altered scenario, the patient remained afebrile; however, on February 24, urinalysis revealed the following results:

- Urinalysis: leukocyte esterase positive, nitrite negative, 5 WBCs/high-power field of spun urine

3. Does this patient now have an HAI? If so, what type?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has a catheter-associated ABUTI.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

CASE STUDY 7

On September 10, a 9-year-old boy with acute lymphocytic leukemia was admitted to a hospital’s oncology ward for a course of chemotherapy. Chest x-ray obtained on admission identified a catheter in the superior vena cava. This dual-lumen catheter had been in place for 2 months without complications. Chemotherapy was started that evening.

On September 16, the patient complained of severe chills after a day of increased lethargy and sleeping following the last round of chemotherapy. The patient was afebrile. Blood specimens for culture were drawn peripherally and through a catheter lumen. Empiric vancomycin and cefotaxime therapy was started via the IV line.

In the early morning of September 17, additional blood specimens for culture were drawn peripherally and through a catheter lumen.

On September 18, the patient was still taking very little of his soft diet or liquids orally. One bottle from the September 16 peripheral blood culture was positive for coagulase-negative staphylococci.
The catheter insertion site was clean, with no redness or drainage. The patient was profoundly neutropenic, with an absolute neutrophil count of 350 cells/mm³. He had moderate diarrhea. Blood cultures from September 17 were still pending.

On September 19, the peripheral blood culture from September 17 was reported to be positive for Staphylococcus epidermidis in 1 of 2 bottles. Cultures from the catheter were again negative. Cefotaxime was discontinued, but IV vancomycin was continued.

1. Does this patient have an HAI? If so, what type?
   a. Yes, the patient has gastroenteritis (GE) with a secondary BSI.
   b. No, the patient does not have an HAI; the catheter is colonized with coagulase-negative staphylococci.
   c. Yes, the patient has a CLABSI with S. epidermidis.
   d. No, the patient has neutropenic enterocolitis, and the blood isolates are contaminants.

Additional or revised details

Continuing the scenario, on September 20, the patient began experiencing abdominal pain and increasing amounts of diarrhea, along with a low-grade fever. At 20:00, the patient doubled over in pain, and additional testing was ordered. The diagnosis was typhlitis. A CT scan detected bowel perforation. The patient was taken to surgery for a right hemicolectomy (ICD-9-CM code 45.73). The primary surgical incision was closed, and a Penrose drain was inserted through a stab wound lateral to the incision.

The patient improved after surgery, taking liquids soon and proceeding to a full diet within 3 days of surgery. The patient was discharged from the hospital with the drain still in place on September 25, with orders for home health care to continue antibiotic administration.

The patient had a postoperative visit with the surgeon on September 29. Drainage from his Penrose drain had increased from a small amount of serous drainage to a large amount of green pus. His abdomen was tender on palpation, and he reported a 2-day bout of diarrhea. He had a low-grade fever and had been vomiting. The surgeon admitted the patient to the hospital for further workup and began triple antibiotic therapy after aseptically obtaining a drainage specimen, which was sent to the laboratory for culture and sensitivity.

On October 1, Gram's stain of the drainage specimen was positive for Serratia marcescens. Antibiotic therapy was adjusted. Over the next few days, the patient's fever subsided and his abdominal pain decreased, and he was discharged to home.

2. Does the patient have a new HAI? If so, what type?
   a. Yes, the patient has an organ/space SSI-IAB, criterion 3a.
   b. No, the patient has community-acquired typhlitis.
   c. Yes, the patient has a deep incisional primary SSI (SSI-SIP).
   d. Yes, the patient has an organ/space SSI at a gastrointestinal tract-specific site (SSI-GIT).

CASE STUDY 8

On July 19, a 13-year-old girl was admitted to the hospital for evaluation and possible surgery related to her recently diagnosed Crohn's disease. A peripherally inserted central catheter (PICC) was placed by the IV team on July 20. Small bowel resection was performed on July 21. After surgery, the patient was transferred to the pediatric ICU (PICU), and total parenteral nutrition (TPN) via the PICC was initiated.

On August 1, the PICC remained in place, her surgical site was healing well, and she had started to take some fluids orally. A peripheral IV (PIV) line was inserted in the dorsum of the right hand for additional IV access. On August 2, the patient experienced severe cellulitis at the site of the PIV, and the line was removed. On August 3, pus was observed at the insertion site. Two sets of blood specimens, as well as a specimen of the pus from the PIV site, were collected, and empiric antibiotic therapy was started. On August 5, 2 bottles from the blood cultures and the PIV site culture were positive for Streptococcus viridans. No other organisms were identified. An echocardiogram showed no evidence of endocarditis. The doctor's note indicates continuing antibiotics for a full 14-day course.

1. Does this patient have an HAI, and if so, what type?
   a. Yes, the patient has a laboratory-confirmed BSI (LCBSI) and because a central line was in place at the time of the infection, this is considered a CLABSI.
   b. Yes, the patient has purulent phlebitis, which is considered a cardiovascular system infection, at an arterial- or venous-specific site (CVS-VASC).
   c. Yes, the patient has an SST-ST, with a secondary BSI.
   d. Yes, the patient has an LCBSI but it is not considered a CLABSI because the infection can clearly be attributed to the peripheral IV site.

Additional or revised details

Continuing the scenario, on August 8, because of the continued need for additional IV access, a PIV line was placed in the right median cubital space. The PICC remained in place and was functioning well.

On August 6-10, the patient was afebrile and taking more food and fluids orally, but her intake was not yet able to meet her nutritional needs, and so TPN was continued via the PICC line. She was transferred to the pediatric medical-surgical ward.

On August 11, the patient reported severe chills and had a mild fever of 100.2°F. Blood cultures were ordered. On August 13, results of 2 sets of blood cultures obtained 20 minutes apart revealed Candida albicans in 1 bottle from each set.

2. Does this patient have a new HAI? If so, what type?
   a. Yes, the patient has a CLABSI that meets criterion 1.
   b. Yes, the patient has a CLABSI that meets criterion 2c.
   c. No, the patient does not have an infection of any type.
   d. Yes, the patient has a new BSI that is secondary to a gastrointestinal tract infection (GI-GIT), criterion 2c.

3. If the patient has an HAI, to which patient care location is the infection attributed?
   a. PICU
   b. Pediatric medical-surgical ward
   c. There is no HAI.

CASE STUDY 9

At 02:00 on June 11, a 49-year-old morbidly obese, diabetic female was admitted through the ED for acute cholecystitis. She was immediately taken to the OR for an emergency cholecystectomy. A Foley catheter was inserted intraoperatively. The operative note indicated that her gall bladder had ruptured. Before the
operative site was thoroughly irrigated, a specimen was sent to the laboratory for culture and sensitivity. A drain was placed through an adjacent stab wound. One dose of ampicillin-sulbactam was administered intraoperatively and continued postoperatively. Although the wound was primarily closed, the surgeon noted that reapproximation was difficult because of the patient’s size. After the operation, the patient was stabilized, the Foley catheter was removed, and the patient was transferred to the surgical ward.

On June 11, the patient’s maximum temperature was 37.8°C. Because the patient could not get out of bed to urinate and was too large to use a bedpan, the Foley catheter was continued. The operative dressing was intact with some serous drainage. A moderate amount of bloody drainage from drain was noted. Normoglycemia was difficult to maintain.

On June 12, results from the intraoperative culture showed E. coli, E. faecalis, and Bacteroides fragilis. Antibiotic therapy was maintained. Her maximum temperature was 38.2°C. Her Foley catheter was draining clear urine, and a moderate amount of bloody drainage was noted from her drain. The patient’s diabetes was still somewhat labile. She was able to ambulate only a minimal distance.

On June 13, the lower end of incision noted to be separating and reddened with continued serous drainage. A moderate amount of bloody drainage from the drain continued. The patient’s maximum temperature was 38.4°C. Starting in the evening, urine from her Foley catheter was cloudy with a foul smell. A sample was sent to the laboratory for culture and sensitivity. The Foley catheter was removed. The patient’s diabetes was better controlled.

On June 14, when the patient tried to get out of bed, the lower portion of her wound opened to the fascia level, which remained intact. A wound swab was collected aseptically and sent to the laboratory for culture and sensitivity. The fascia and muscle sutures were holding well. The incision was cleaned and packed, and wet-to-dry dressings were ordered. Bloody drainage from the surgical drain was decreased. The patient’s maximum temperature was 38.5°C. A new Foley catheter was inserted, and the patient was confined to bed to encourage wound healing. The patient felt nauseous throughout the day; her blood sugar was better controlled.

On June 15, drainage from surgical drain was thicker. A specimen was sent to the laboratory for culture and sensitivity. The skin around the surgical drain was red and swollen, and the incision continued to seep. The patient continued to complain of nausea despite taking antinausea medication. Her maximum temperature was 38.8°C. Urine culture results showed Pseudomonas aeruginosa >100,000 CFU/mL. Ampicillin-sulbactam was discontinued, and imipenem was started.

On June 16, wound swab culture results showed no growth. The incision appeared better, with less weeping. Thick drainage continued from the surgical drain and the skin around the drain had not improved. Urine was less cloudy.

1. As of June 16, does this patient have an HAI? If so, what type?
   a. Yes, the patient has a CA-SUTI.
   b. Yes, the patient has a CA-SUTI and an SSI-SIP.
   c. Yes, the patient has a CA-SUTI and an organ/space SSI-IAB.
   d. No, the patient’s gall bladder was infected at the time of surgery, so any subsequent infection at that site is considered community-acquired.

Additional or revised details

Continuing the scenario, on June 17, the drain specimen culture grew P. aeruginosa and Citrobacter spp. The patient’s diabetes was better controlled. Imipenem was continued. Her maximum temperature was 38.1°C, and her urine was clearer. The condition of her incision was improving, and seepage was minimal. Skin breakdown was noted around the surgical drain with some drainage and continued redness and swelling. A specimen for culture was obtained from the drain. The patient’s nausea was subsiding.

2. With this additional information, which of the following describes the patient’s infection(s) to date?
   a. The patient was infected on admission and has no new HAIs.
   b. The patient has a SUTI.
   c. The patient has both a SUTI and an SSI-IAB.
   d. The patient has a SUTI, an SSI-SIP, and an SSI-IAB.

Additional or revised details

Continuing the scenario, on June 19, culture results of drainage from skin around surgical drain showed light growth of MRSA. The surgical drain was removed, and a topical antibiotic was ordered for application to the affected area. The patient’s maximum temperature was 37.7°C. Her urine was clear, and the Foley catheter was removed. The patient’s incision was healing well, and she was encouraged to ambulate.

3. With this additional information, which of the following choices describes the patient’s infection to date?
   a. The patient has a SUTI and a superficial incisional SSI at the secondary (drain) site (SSI-SIS).
   b. The patient has a SUTI, an SSI-IAB, and an SST-SKIN infection.
   c. The patient has a SUTI, an SSI-SIP, an SSI-IAB, and an SST-SKIN infection.
   d. The patient has a SUTI, an SSI-SIP, an SSI-IAB, and an SSI-SIS.
**ANSWER SHEET**

You may detach this sheet and use it to record your responses. This will facilitate entering your responses into the online submission system to obtain your continuing education credits.

**Case Study #1**

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**Case Study #3**

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**Case Study #8**

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**Case Study #9**

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Case Study #1

1. **Which of the following is the correct way to report this patient’s operative procedure category to NHSN?**
   a. Vaginal hysterectomy (VHYS)
   b. Abdominal hysterectomy (HYST)
   c. **Neither a nor b; this is not an NHSN operative procedure**
   d. Both a and b

**Explanation**
Because this patient’s incision was not closed primarily (i.e., there was not skin-to-skin closure of the entire incision) it does not meet the NHSN definition of an operative procedure and therefore it cannot be reported to NHSN as either a vaginal or abdominal hysterectomy. Do not enter or import a Denominator for Procedure record for this patient.

The definition of an NHSN operative procedure is: A procedure

1) that is performed on a patient who is an NHSN inpatient or an NHSN outpatient; 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) is included in Table 1, NHSN Operative Procedure Category Mappings to ICD-9-CM Codes. 1 (page 9-7)

2. Does this patient have an HAI attributable to the hospital? If so, what type(s)?
   a. Yes, the patient has skin and soft tissue infection of the deep soft tissues (SST- ST).
   b. Yes, the patient has a deep incisional SSI of the primary incision (SSI-DIP).
   c. No, the patient has an HAI attributable to the ECF.

Explanation
Because the procedure did not qualify as an NHSN operative procedure, the resulting infection cannot be called a surgical site infection (SSI) and therefore the 30-day rule for identifying SSI does not apply. Since the onset of infection was greater than 48 hours after hospital discharge, it cannot be attributed to the hospital stay and therefore if it meets infection surveillance criteria for soft tissue infection in use at the ECF it must be attributed to the ECF. The fact that the patient was colonized with MRSA preoperatively does not negate that this is an HAI.

3. Given this revised scenario, which of the following is the correct way to report this patient’s operative procedure category and use of laparoscope to the NHSN?
   a. Abdominal hysterectomy; endoscope: no
   b. Abdominal hysterectomy; endoscope: yes
   c. Vaginal hysterectomy; endoscope: no
   d. Vaginal hysterectomy; endoscope: yes

Explanation
Laparoscopic-assisted abdominal hysterectomy procedures are included in the NHSN operative procedure category abdominal hysterectomy (HYST).

Information from the NHSN Patient Safety Manual, Tables of Instructions regarding the field “Endoscope,” instructs:

Required. Check Y if the entire operative procedure was performed using an endoscope/laparoscope. Check N if the endoscope incision was extended to allow hand assistance, or was fully converted to an open approach.

Because this patient’s laparoscopic incision was extended to allow for the insertion of the surgeon’s hand, the Endoscope field must be recorded as “No.”
4. In light of the revised scenario in which the incision is completely closed during the procedure, does this patient have an HAI attributable to the hospital? If so, what type?
   a. Yes, the patient has an SST-ST.
   b. **Yes, the patient has an SSI-DIP.**
   c. No, the patient has an HAI attributable to the ECF.

**Explanation**
With primary closure, this surgery now meets the NHSN definition of an operative procedure and therefore a subsequent infection can be called an SSI if criteria are met.\(^1\) This infection meets criteria a and b for a deep incisional SSI as it occurred within 30 days after the operative procedure and involved deep soft tissues (e.g., fascial and muscle layers) of the incision with both “purulent drainage from the deep incision but not from the organ/space component of the surgical site” and “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 (\(>38^\circ\)C), or localized pain or tenderness.”\(^*1\) (page 9-9)

5. If a patient who had a primarily closed laparoscopic abdominal hysterectomy develops infection in 2 of 3 laparoscopic incisions, how many incisional SSIs should be reported to NHSN?
   a. Three
   b. Two
   c. **One**
   d. None

**Explanation**
All laparoscopic incisions are considered part of the same laparoscopic surgical procedure. When one or more of the incisions become infected, only one SSI is reportable to NHSN.\(^1\) (page 9-13)
Case Study #2

1. **Does this patient have an HAI? If so, what type(s)?**
   a. Yes, the patient has a SKIN infection with a secondary bloodstream infection (BSI) with *E. faecium* VRE.
   b. No, these organisms are colonizers. The patient’s fever is related to pulmonary atelectasis.
   c. Yes, the patient has a SKIN infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).
   d. Yes, the patient has a soft tissue (ST) infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).

**Explanation**
This patient meets SKIN infection criteria 1, 2a, and 2b, respectively: “purulent drainage, pustules, vesicles, or boils”; “at least 2 of the following signs or symptoms with no other recognized cause: pain, or tenderness, localized swelling, redness, or heat and at least 1 of the following: organisms cultured from aspirate or drainage from affected site; if organisms are normal skin flora (i.e., diphtheroids [Corynebacterium spp], Bacillus [not *B. anthracis*] spp, Propionibacterium spp, coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci, *Aerococcus* spp, *Micrococcus* spp), they must be a pure culture”; and “organisms cultured from blood.”

The primary infection site is SKIN and not ST since the cellulitis was superficial and did not involve deeper tissues.

When determining if a bloodstream infection is the primary infection site or secondary to an infection at another site, there is no requirement for the antibiograms of the blood culture isolate(s) and the antibiogram of the isolate(s) from the primary infection site culture to match. The isolate(s) must match only at the genus level and at the species level if this information is available for the bloodstream infection to be considered secondary to the primary infection site. “Microbiologic cultures are polyclonal. While colonies should be selected for susceptibility testing based on differing morphologies, this does not assure a complete antibiotic susceptibility profile of the entire culture, therefore differing antibiograms for the same genus and species within a culture is not uncommon.”

Because the BSI is secondary to the SKIN infection, it is not reported as a CLABSI.

2. **Does this change your determination of the type(s) of HAI(s) present?**
   a. No, this is still a SKIN infection with a secondary BSI due to *E. faecium* (VRE).
   b. **Yes, this is an ST infection with a secondary BSI due to *E. faecium* (VRE).**
   c. Yes, this is an ST infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).
Explanation
Even though the patient still meets criteria for SKIN, she also meets criterion 4a for ST infection due to progression of the cellulitis to the fascia. She meets criteria 4 by having “at least 2 of the following signs or symptoms at the affected site with no other recognized cause: localized pain or tenderness, redness, swelling, or heat” and “organisms cultured from blood.”

Therefore, in such situations, only the more serious (i.e., deeper) infection would be reported.

3. Does this change your determination of the type(s) of HAI(s) present?
   a. No, the patient has a SKIN infection with a secondary BSI due to *E. faecium* (VRE).
   b. Yes, the patient has a CLABSI due to *E. faecium* (VRE).
   c. No, the patient has a SKIN infection with *E. faecium* (VRE) and a CLABSI with *E. faecium* (VSE).

Explanation
When there is a positive blood culture and clinical signs or symptoms of localized infection at a vascular access site, but no other infection can be found, the infection is considered a primary BSI.
Case Study #3

1. **Does this patient have an HAI? If so, what type(s)?**
   a. Yes, the patient has a BSI with *E. cloacae* with a secondary superficial incisional primary (SIP) SSI.
   b. **Yes, the patient has a SIP-SSI due to *E. cloacae*, with a secondary BSI.**
   c. Yes, the patient has a symptomatic urinary tract infection (SUTI) with *E. coli* and an SIP-SSI due to *E. cloacae*, with a secondary BSI.

**Explanation**

This patient meets criteria a and c for SIP-SSI, respectively: “Infection occurs within 30 days of the operative procedure and involves only skin and subcutaneous tissue of the incision and the patient has purulent drainage from the superficial incision” and “…The patient has at least one of the following signs and symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is deliberately opened by surgeon, and is culture-positive or not cultured.”

Therefore, the bloodstream infection is secondary to the primary infection site of SIP-SSI. “When assessing positive blood cultures, be sure there is no other CDC-defined primary site of HAI that may have seeded the bloodstream secondarily.”

This patient does not meet criterion 2a for SUTI due to the negative urinalysis.

2. **To which operative procedure code is the SSI attributed?**
   a. COLO (colon surgery)
   b. **OTH (splenic vein laceration repair)**

**Explanation**

If a patient has several NHSN operative procedures prior to an infection, report the operative procedure code 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.

The ICD-9-CM 39.32 code is included in the NHSN Operative Procedure Category OTH, (Other Operative Procedure). Therefore, the correct attribution in this scenario is to OTH.
3. What is your assessment of the subsequent infection now?
   a. The patient has a BSI with *E. cloacae*, with a secondary SIP-SSI.
   b. The patient has a SUTI with *E. coli* and a skin and soft tissue infection at the skin- specific site (SST-SKIN) due to *E. cloacae*, with a secondary BSI.
   c. The patient has a SIP-SSI due to *E. cloacae*, with a secondary BSI.
   d. The patient has an SST-SKIN due to *E. cloacae*, with a secondary BSI.

**Explanation**
Anything which prevents the surgical incision from being closed primarily, i.e., the skin edges from being entirely approximated, does not meet the definition of an NHSN operative procedure. Therefore, the September 17th surgery in which the drain exited through the incision cannot be called an NHSN operative procedure. Hence any subsequent infection cannot be called an SSI. The infection does however meet criteria 1 and 2b of the skin specific site, respectively: “purulent drainage, pustules, vesicles, or boils” and “at least 2 of the following signs or symptoms with no other recognized cause: pain, or tenderness, localized swelling, redness, or heat and organisms cultured from blood.”

The patient still does not meet criteria 2a for SUTI as there is no positive urinalysis.
Case Study #4

1. **Does this patient have an HAI? If so, what type(s)?**
   a. Yes, the patient has a superficial incisional SSI.
   b. No, the patient does not have an HAI; her fever is related to the lactation process.
   c. Yes, the patient has a SKIN infection related to her irritated nipples.
   d. **Yes, the patient has an organ/space SSI at the specific site of endometritis (SSI-EMET).**

**Explanation**
In order to have an organ/space SSI, a patient must meet both the general organ/space SSI criteria as well as the criteria for one of the specific sites of organ/space infections. This patient meets criterion d of organ/space SSI: “diagnosis of an organ/space SSI by a surgeon or attending physician.”

She also meets criterion 2 of endometritis (EMET): “Patient has at least 2 of the following signs or symptoms with no other recognized cause: fever (>38°C), abdominal pain, uterine tenderness, or purulent drainage from uterus.”

2. **What is your assessment of the infection(s) in light of this additional information?**
   a. This is an SSI-EMET only.
   b. **The patient has both an SIP-SSI and an SSI-EMET.**
   c. The patient has a SIP-SSI only.
   d. More information is needed to make a determination.

**Explanation**
In addition to the organ/space SSI, the patient also meets criterion a of superficial incisional SSI with “purulent drainage from the superficial incision.”

The C-section incision is the primary (and only) incision and therefore this is an SIP-SSI. Because the fascia is intact, the deep incision does not appear to be involved. There appear to be two separate infectious processes at work. If the fascia had not been intact, then only one SSI would be reported, a deep incisional SSI. The organ/space EMET would not be reported according to the first bullet of the Reporting Instructions for organ/space SSI: “Occasionally an organ/space infection drains through the incision and is considered a complication of the incision. Therefore, classify it as a deep incisional SSI.”
Case Study #5

1. **At the end of the case, what would you expect the surgical wound class to be?**
   a. Clean
   b. **Clean-contaminated**
   c. Contaminated
   d. Dirty/infected

**Explanation**
Under normal circumstances, one would expect the wound class of a laparoscopic gastric bypass procedure to be reported as class clean-contaminated. Since the alimentary (GI) tract is entered, this patient’s procedure does not meet the definition of a clean wound class. Also, since there is no indication that there was a break in sterile technique or gross spillage from the GI tract nor inflammation or pus, it likewise does not meet the definition of either a contaminated or dirty/infected wound class.

Clean-contaminated: Operative wounds in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.

2. **What was the duration of the operative procedure?**
   a. 2 hours, 36 minutes
   b. **2 hours, 25 minutes**
   c. 2 hours, 45 minutes

**Explanation**
In NHSN, the duration of operative procedure is the interval between skin incision and skin closure (“skin-to-skin” time). The first incision is made at 09:18 and the last incision is closed at 11:43. The time separation is 2 hours and 25 minutes. Neither the time of entrance to the OR or the start of the pre-operative antibiotics is used when determining the duration of operative procedure.

3. **Does this patient have an HAI? If so, what type(s)?**
   a. No; the large intestine was perforated during the initial operation, and thus any subsequent infection is considered a surgical complication, not an HAI.
   b. **Yes, the patient has an SSI at the intra-abdominal specific site (SSI-IAB).**
   c. No, peritoneal fluid was not cultured, and so no HAI criteria were met.
   d. Yes, the patient has a deep incisional primary SSI (DIP-SSI).
Explanation
The patient meets organ/space surgical site infection criterion c “…other evidence of infection is found…during reoperation.” This evidence manifests as the inflamed tissues and purulent fluid. The patient also meets intra-abdominal (IAB) specific site infection criterion 2 “…other evidence of infection involving the organ/space that is found …during reoperation,” in the form of inflamed tissues and purulent fluid. In addition, he meets IAB criterion 3c “Patient has at least 2 of the following signs or symptoms with no other recognized cause: fever (>38°C), nausea, vomiting, abdominal pain, or tenderness and at least 1 of the following: c. organisms cultured from blood and radiographic evidence of infection (e.g., …abnormal findings on CT scan…).” Specifically, the patient developed fever and abdominal pain within 15 hours of the laparoscopic gastric bypass operation, grew *Bacteroides fragilis* (a common intestinal organism) from the blood, and had abnormal CT scan findings (free fluid).

4. If there is an HAI, what was the date of infection?
   a. March 8
   b. **March 9**
   c. There is no HAI.

Explanation
Although the cause of the infection is likely the perforated bowel which occurred on March 8, the day of the first surgery, the onset of symptoms did not occur until the following morning, March 9.

5. Assuming that the perforated large intestine is due to the introduction of the trocar during the primary procedure, should the wound class for the March 8 operative procedure be changed, and if so, to what?
   a. No, it should not be changed.
   a. Yes, it should be changed to clean-contaminated, and the procedure performed on March 9 should be considered contaminated.
   b. Yes, both the March 8 and March 9 procedures should be considered contaminated.
   c. Yes, it should be changed to contaminated. The March 9 procedure is considered dirty/infected.

Explanation
Surgical wound class is an assessment of the degree of contamination of the surgical wound at the time of the operation. Had the initial gastric bypass on 3/8 been uneventful and without probable perforation to the bowel, as evidenced by unexpected resistance on introduction of the trocar, the wound class would have been considered clean-contaminated. However, the bowel perforation introduced gross spillage into the operative field rendering the procedure contaminated, although in this scenario the
spillage was not detected prior to the close of the case. Therefore, the gastric bypass procedure's wound class should be changed from clean-contaminated to contaminated, reflecting the spillage that was not immediately evident during the operation. The subsequent procedure on 3/9 clearly involved an infected space and therefore the wound class is considered dirty/infected.

Contaminated: Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered are included in this category.

Dirty or Infected: Includes old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.
Case Study #6

1. Does this patient have an HAI? If so, what type(s)?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has a catheter-associated symptomatic urinary tract infection (CA-SUTI) with a secondary BSI.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

Explanation
This patient meets criterion 1a of SUTI. An indwelling catheter was in place at the time of the specimen collection or onset of signs and symptoms, and she is symptomatic (fever >38°C), and she has a positive urine culture of >100,000 CFU/ml with no more than 2 species of microorganisms. Because the organism that is recovered from the blood culture is related to an infection at another site that meets criteria for an NHSN HAI (SUTI), the bacteremia is considered secondary to the SUTI and is not reported as a primary BSI.

2. Does this patient now have an HAI? If so, what type?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has an asymptomatic bacteremic urinary tract infection (ABUTI) that is catheter-associated.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

Explanation
Because this patient now does not exhibit ANY of the symptoms required to meet criteria for SUTI in a catheterized patient (i.e., no fever >38°C, suprapubic tenderness, or costovertebral angle pain or tenderness), but her urine culture is positive for a microorganism with >10^5 CFU/ml, and the organism recovered from the bloodstream matches a uropathogen in the urine, the NHSN criterion for ABUTI is satisfied.

3. Does this patient now have an HAI? If so what type?
   a. No, the patient does not have an HAI.
   b. Yes, the patient has a CLABSI.
   c. Yes, the patient has a catheter-associated ABUTI.
   d. Yes, the patient has both a CLABSI and a CA-SUTI.

Explanation
The addition of the positive urinalysis findings does not alter the determination since there are still no symptoms of a UTI. Therefore it cannot be a SUTI and remains an ABUTI.
Case Study #7

1. Does this patient have an HAI? If so, what type?
   a. Yes, the patient has gastroenteritis (GE) with a secondary BSI.
   b. No, the patient does not have an HAI; the catheter is colonized with coagulase-negative staphylococci.
   c. Yes, the patient has a CLABSI with \textit{S. epidermidis}.
   d. No, the patient has neutropenic enterocolitis and the blood isolates are contaminants.

Explanation
The patient has a central line and meets criterion 2 and Notes 3 and 4 of laboratory-confirmed bloodstream infection (LCBI): “Patient has at least one of the following signs or symptoms: fever (>38°C), chills, or hypotension and signs and symptoms and positive laboratory results are not related to an infection at another site and common commensal (i.e., diphtheroids \textit{[Corynebacterium spp. not C diphtheriae]}, \textit{Bacillus spp. [not B anthracis]}, \textit{Propionibacterium spp.}, coagulase-negative staphylococci [including \textit{S epidermidis}], viridans group streptococci, \textit{Aerococcus spp.}, \textit{Micrococcus spp.}) is cultured from two or more blood cultures drawn on separate occasions.”\textsuperscript{5} (page 4-3 thru 4-4)

Per Note 3, “the phrase ‘two or more blood cultures drawn on separate occasions’ means 1) that blood from at least two blood draws were collected within two days of each other and 2) that at least one bottle from each blood draw is reported by the laboratory as having grown the same common commensal (i.e., is a positive blood culture).”\textsuperscript{5} (page 4-4)

Finally per Note 4, the organism for the CLABSI should be reported as \textit{S. epidermidis}: “If the common commensal is identified to the species level from one culture, and a companion culture is identified with only a descriptive name (e.g., to the genus level), then it is assumed that the organisms are the same. The organism identified to the species level should be reported as the infecting pathogen along with its antibiogram if available (Table 1).”\textsuperscript{5} (page 4-5)
Table 1. Examples of how to report speciated and unspeciated common commensals

<table>
<thead>
<tr>
<th>Culture Report</th>
<th>Companion Culture Report</th>
<th>Report as…</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. epidermidis</td>
<td>Coagulase-negative staphylococci</td>
<td>S. epidermidis</td>
</tr>
<tr>
<td>Bacillus spp. (not anthracis)</td>
<td>B. cereus</td>
<td>B. cereus</td>
</tr>
<tr>
<td>S. salivarius</td>
<td>Strep viridans</td>
<td>S. salivarius</td>
</tr>
</tbody>
</table>

2. Does the patient have a new HAI? If so, what type?
   a. Yes, the patient has an organ/space SSI-IAB, criterion 3a.
   b. No, the patient has community-acquired typhlitis, a severe side effect of neutropenia and chemotherapy.
   c. Yes, the patient has a deep incisional primary SSI (SSI-SIP)
   d. Yes, the patient has an organ/space SSI at the gastrointestinal tract—specific site (SSI-GIT).

Explanation
This patient meets organ/space SSI criterion a “purulent drainage from a drain that is placed through a stab wound into the organ/space”\(^1\) and criterion 3a of the specific infection site of intra-abdominal (IAB) “Patient has at least 2 of the following signs or symptoms with no other recognized cause: fever (>38°C), nausea, vomiting, abdominal pain, or jaundice and at least 1 of the following: a. organisms cultured drainage from surgically placed drain.”\(^4\) The patient had a low-grade fever, abdominal pain (which could have been due to the diarrhea), and vomiting, plus Serratia marcescens from the Penrose drainage specimen, all occurring within 30 days of the colon surgery.

Additional Information:
This is an IAB and not a GIT because the intra-abdominal cavity is included in the areas involved in infections of the IAB type but not those included in the organs and areas listed in the GIT definition.\(^4\) (pages 321-22)

GE infections are not included as one of the types of organ/space SSIs as listed in Table 2 Specific Sites of an Organ/Space SSI in chapter 9 of the NHSN manual.\(^1\) (page 9-10 thru 9-11)
Therefore there can be no SSI-GE.
Case Study #8

1. **Does this patient have an HAI, and if so, what type?**
   a. Yes, the patient has a laboratory-confirmed BSI (LCBI) and because a central line was in place at the time of the infection, this is considered a CLABSI.
   b. Yes, the patient has purulent phlebitis, which is considered a cardiovascular system infection, at an arterial or venous-specific site (CVS-VASC).
   c. Yes, the patient has an SST-ST, with a secondary BSI.
   d. Yes, the patient has an LCBI but it is not considered a CLABSI because the infection can clearly be attributed to the peripheral IV site.

**Explanation**
Occasionally, a patient with both peripheral and central IV lines develops a primary bloodstream infection (LCBI) that can clearly be attributed to the peripheral line (e.g., pus at the insertion site and matching pathogen from pus and blood). When reporting this infection to NHSN, mark Central Line = No.² (page 4-6)

2. **Does this patient have a new HAI? If so, what type?**
   a. Yes, the patient has a CLABSI that meets criterion 1.
   b. No, the patient has a continuation of the original BSI episode, not a new HAI.
   c. No, the patient does not have an infection of any type.
   d. Yes, the patient has a new BSI that is secondary to a gastrointestinal tract infection (GI-GIT), criterion 2c.

**Explanation**
The previous infection is being treated and the patient is showing improvement. A new pathogen with new signs and symptoms of infection are now identified in a patient with a central line. This patient has a new HAI meeting BSI-LCBI criterion 1: “Patient has a recognized pathogen cultured from one or more blood cultures and the organism cultured from the blood is not related to an infection at another site.”² (page 4-3) Because the PICC line is still in place and there are no obvious signs of infection at other vascular access sites, it is considered a CLABSI.
3. **If the patient has an HAI, to which patient care location is the infection attributed?**

   a. PICU
   b. Pediatric medical-surgical ward
   c. There is no HAI.

**Explanation**

The NHSN transfer rule states “if a device-associated infection develops within 48 hours of transfer from one inpatient location to another in the same facility, the infection is attributed to the transferring location.”

In this case, since the first symptoms of the BSI occurred within 48 hours of transfer from the PICU, the attribution of the infection would be to the PICU.
Case Study #9

1. **As of June 16, does this patient have an HAI? If so, what type?**
   a. Yes, the patient has a CA-SUTI.
   b. Yes, the patient has a CA-SUTI and an SSI-SIP.
   c. Yes, the patient has a CA-SUTI and an organ/space SSI-IAB.
   d. No, the patient’s gall bladder was infected at the time of surgery, so any subsequent infection at that site is considered community-acquired.

**Explanation**
Based on the information available on June 16, the patient meets criterion 1a for SUTI: “Patient had an indwelling urinary catheter in place at the time of specimen collection or onset of signs or symptoms and fever (>38°C) and a positive urine culture of ≥100,000 CFU/ml with no more than 2 species of microorganisms” (in this case, *Pseudomonas aeruginosa*).\(^7\) Although the intraoperative culture was positive, there was no documentation of purulence in the operative field nor was the patient febrile at that time. Also, even though the patient had a fever by June 12, and part of her incision was red and beginning to separate on June 13, the sutures in the deepest part of the operative site were intact and the wound culture was negative. Therefore, none of the criteria for either superficial incisional or deep incisional SSI are met on June 16. Similarly, although a change in character of the drainage from the surgical drain rouses suspicion for organ/space SSI on June 15, purulence was not documented and no culture results are available on June 16 to aid in meeting the criteria for this type of infection.

2. **With this additional information, which of the following describes the patient’s infection(s) to date?**
   a. The patient was infected on admission and has no new HAIs.
   b. The patient only has a SUTI.
   c. **The patient has both a SUTI and an SSI-IAB.**
   d. The patient has a SUTI, an SSI-SIP, and an SSI-IAB.

**Explanation**
The additional information provided by the positive culture of drainage from the surgical drain allows criterion b of the organ/space SSI and criterion 3a of the specific site IAB to be met as follows:

Organ/space SSI criterion b.\(^1\)
Infection occurs within 30 days after the operative procedure if no implant is left in place or within one year if implant is in place and the infection appears 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 1 of the following:

b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.

IAB criterion 3a:

Patient has at least 2 of the following signs or symptoms with no other recognized cause: fever (>38°C), nausea, vomiting, abdominal pain, or tenderness and at least 1 of the following:

a. organisms cultured from drainage or tissue obtained during a surgical operation or endoscopy or from a surgically placed drain.

3. With this additional information, which of the following choices describes the patient’s infection to date?

a. The patient has a SUTI and a superficial incisional SSI at the secondary (drain) site (SSI-SIS).

b. **The patient has a SUTI, an SSI-IAB, and an SST-SKIN infection.**

c. The patient has a SUTI, an SSI-SIP, an SSI-IAB, and an SST-SKIN infection.

d. The patient has a SUTI, an SSI-SIP, an SSI-IAB, and an SSI-SIS.

**Explanation**

Infected surgical drain sites are not considered surgical site infections since neither the operative incision nor organ/space are involved. Instead, such infections are considered skin and soft tissue infections and depending on the depth of the infection can either meet the skin or soft tissue specific site criteria. In this case, criterion 2a of the skin specific site criteria is met: “2. Patient has at least 2 of the following signs or symptoms with no other recognized cause: pain or tenderness, localized swelling, redness, or heat and

a. organisms cultured from aspirate or drainage from affected site; if organisms are normal skin flora (i.e., diphtheroids [Corynebacterium spp.], Bacillus spp. [not B anthracis], Propionibacterium spp., coagulase-negative staphylococci [including S epidermidis], viridans group streptococci, Aerococcus spp., Micrococcus spp.), they must be a pure culture.”
REFERENCES


