HHS Public Access

Author manuscript

Am J Infect Control. Author manuscript; available in PMC 2019 May 13.

Published in final edited form as:

Am J Infect Control. 2012 June ; 40(5 Suppl): S32–S40. doi:10.1016/j.ajic.2012.03.010.

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

Marc-Oliver Wright, MT(ASCP), MS, CIC[a,*], **Joan N. Hebden, RN, MS, CIC**[b], **Kathy Allen-Bridson, RN, BSN, MScPH, CIC**[c], **Gloria C. Morrell, RN, MS, MSN, CIC**[c], and **Teresa C. Horan, MPH**[c]

[a]Department of Infection Control, NorthShore University HealthSystem, Evanston, IL

[b]Infection Prevention and Control Consultant, Baltimore, MD

[c]National Healthcare Safety Network, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, GA

Abstract

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.

Keywords

NHSN; Surveillance

In June 2010, the *American Journal of Infection Control* began publishing a case series of health care-associated infection (HAI) surveillance scenarios with associated questions and answers approved by staff at the National Healthcare Safety Network (NHSN). The case studies represent everyday complex clinical scenarios encountered by infection preventionists (IPs) and highlight the accurate application of the NHSN surveillance definitions. Participants are invited to submit their answers online and to receive the correct

[*]Address correspondence to Marc-Oliver Wright, NorthShore University HealthSystem, Department of Infection Control, 2650 Ridge Avenue, Burch 124, Evanston, IL 60201. MWright@northshore.org (M.-O. Wright).

Conflict of interest: The Centers for Disease Control and Prevention, our partners, and our content experts disclose no financial interests or other relationships with the manufacturers of commercial products, suppliers of commercial services, or commercial supporters, with the exception of Marc-Oliver Wright, who received an honorarium from Carefusion, Inc. This supplement does not include any discussion of the unlabeled use of a product or a product under investigational use. The Centers for Disease Control and Prevention does not accept commercial support. The findings and conclusions in this supplement are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

answers along with explanations citing the applicable definitions and reporting instructions from the NHSN Patient Safety Component Manual.

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 (eg, 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 than respondents from states where no such reporting (and presumably, optional training in NHSN) was required (relative risk [RR], 1.06; 95% onfidence interval [CI], 1.01–1.11; $P = .02$).

Since those early case studies, the NHSN has released a series of new and updated training modules. In addition, facilities in the remaining 28 states are de facto required to participate in the NHSN to fulfill the inpatient Quality Reporting Program requirements of the Centers for Medicare and Medicaid Services (CMS). Ongoing evaluation of the data generated by

these case studies will allow further evaluation of variation in comprehension and utilization of NHSN definitions. Although nearly two-thirds of the responses were correct, ample opportunities for improvement remain. This supplement represents another component of the ongoing effort to educate IPs in the correct application of these nuanced surveillance definitions.

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 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.

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 course title. The course information page will come up. Scroll down to **Register Here.** Choose **Audit** and then **Submit.** Three demographic questions will come up. Complete the questions and then **Submit.**
- If you have already completed the course, you may go directly to the evaluation. Complete the evaluation and **Submit.** A record of your course completion and your **Audit** certificate will be located in the **Transcript and Certificate** section of your record.

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/mm^3. 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.

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).

Additional or revised Detail

Let's change the scenario. The patient no longer experienced any right groin pain, redness or purulent discharge. Instead, on the same day, the pain, redness and purulent discharge were all at the exit site of the right IJ catheter, not at the cardiac catheterization site.

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).

CASE STUDY 3

A 63-year-old previously healthy male was admitted on September 15 for elective sigmoid colon resection after a colonoscopy detected a cancerous polyp. A right hemicolectomy was performed laparoscopically without complications, and the patient was successfully

extubated in the OR. In the postanesthesia recovery area, his blood pressure was labile, prompting a decision to keep the right IJ catheter and urinary catheter in place and to transfer him to the surgical intermediate care unit (SIMC).

On September 16, his vital signs were stable, but his urinary output dropped to <30 mL/hour, and his bowel sounds were barely detectable. His activity was increased to ambulation with assistance, IV fluids were increased to 150 mL/hour, and he was receiving ice chips only. He was self-administering morphine sulfate via a patient-controlled analgesia pump.

On September 17, his bowel sounds remained diminished, and he exhibited abdominal distention and increased pain. His vital signs revealed mild tachycardia and a blood pressure of 90/60 mmHg. Morning complete blood count revealed a substantial drop in hemoglobin, to 8.7, and in hematocrit, to 29. His surgeon ordered computed tomography of the abdomen, which showed evidence of fluid in the peritoneum suggestive of blood. 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 pipercillin/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 (splenic 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. Moderate

bloody vaginal drainage continued. The patient complained of mild abdominal pain and received acetaminophen with codeine, with good results.

On April 9, the patient had progressed to a regular diet, although she complained of mild nausea and ate very little of her breakfast. Her temperature in the morning was 38.2°C. Her heparin-lock site appeared normal. Her lungs remained clear bilaterally, and she was ambulating independently. Her incision was reddened and warm to the touch, she continued to complain of abdominal pain, and although her lochia had decreased slightly, she complained of a foul odor. Her uterus was tender to palpation. She had begun to lactate, and her baby was nursing well. According to the physician's notes, IV ampicillin and gentamicin were started for endometritis.

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).

Additional or revised details

Continuing the scenario, on April 9, a moderate amount of purulence was noted on the midportion of the patient's abdominal incision. The incision was probed, and the fascia was found to be intact.

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.

CASE STUDY 5

A 46-year-old male with obesity and poorly controlled diabetes mellitus was admitted on March 8 and underwent scheduled laparoscopic gastric bypass surgery. The patient was brought to the OR at 08:58, and the first dose of antibiotics (cefalexin) was administered at 09:07. The first incision was made at 09:18. The primary trocar was introduced with some unexpected resistance, but no apparent immediate injury. Three additional trocars were subsequently introduced, and the procedure continued without incident until the last of the 4 incisions was closed at 11:43. 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

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 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).
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 rhonchii 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 symptomatic 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/mm^3 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/mm^3. 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 marcesens*. 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, 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 a gastrointestinal tractespecific 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 (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.

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.** 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.
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

1.	A	B	C	D
2.	A	B	C	
3.	A	B	C	D
4.	A	B	C	
5.	A	B	C	D

Case Study #2

1.	A	B	C	D
2.	A	B	C	
3.	A	B	C	

Case Study #3

1.	A	B	C	
2.	A	B		
3.	A	B	C	D

Case Study #4

1.	A	B	C	D
2.	A	B	C	D

Case Study #5

1.	A	B	C	D
2.	A	B	C	
3.	A	B	C	D
4.	A	B	C	
5.	A	B	C	D

Case Study #6

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D

Case Study #7

1.	A	B	C	D
2.	A	B	C	D

Case Study #8

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	

Case Study #9

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D

Acknowledgments

Publication of this supplement was made possible by an unrestricted educational grant from BD.

We thank Courtney Lee, National Healthcare Safety Network Health Educator, for her invaluable work in helping us improve these case studies and for arranging for CEU awards for these case studies.

Table 1

Summary of findings from the first 5 published NHSN case studies

Case study	NHSN event type	Participants	Questions	Overall correct	Areas of difficulty
1	CLABSI	811	4	2,208 of 3,244; 68.1%	● No minimum central line duration. ● Concurrent infections can be independent events.
2	CLABSI due to common commensal	807	3	1,947 of 2,421; 80.4%	● Concurrent infections can be independent events. ● Tendency to disregard common commensals.
3	Ventilator-associated pneumonia	524	2	636 of 1,048; 60.7%	● No minimum ventilator duration. ● Cannot use sputum as a minimally contaminated specimen.
4	CLABSI/SUTI	705	4	1,578 of 2,820; 56.0%	● 38°C does not meet fever requirement. ● CLABSI with recognized pathogen does not require symptoms.
5	SSI	727	4	1,610 of 2,908; 55.4%	● Date of the infection is when onset of symptoms appear. ● SSIs are attributed to the month of the surgery, not infection onset. ● An organ/space SSI that drains through the incision is classified as a deep incisional SSI.

Am J Infect Control. Author manuscript; available in PMC 2019 May 13.