CDC/NHSN Surveillance Definitions for Specific Types of Infections

NOTE: Substantive changes have been made to this chapter, including edits, additions, and deletions.

INTRODUCTION

This chapter contains the CDC/NHSN surveillance definitions and criteria for all specific types of infections. Comments and reporting instructions that follow the site-specific criteria provide further explanation and are integral to the correct application of the criteria. This chapter also provides additional required criteria for the specific infection types that constitute organ space surgical site infections [SSI] (e.g., mediastinitis [MED] that may follow a coronary artery bypass graft, intra-abdominal abscess [IAB] after colon surgery, etc.). Refer to Chapter 2 (Identifying HAIs in NHSN) for specific guidance for making HAI determinations.

Infection criteria contained in this chapter may be necessary for determining whether a positive blood culture represents a primary bloodstream infection (BSI) or is secondary to a different type of infection (see Appendix 1 Secondary Bloodstream Infection (BSI) Guide). A BSI that is identified as secondary to another site of infection must meet one of the infection criteria detailed in this chapter. Secondary BSIs are not reported as separate events in NHSN, nor can they be associated with the use of a central line.

NOTE: Criteria for urinary tract infections (UTI), bloodstream infection (BSI), pneumonia (PNEU) infections, ventilator-associated events (VAE) and surgical site infections (SSI) are no longer included within this chapter. For those criteria, see individual protocol chapters included separatately at the end of this chapter.

CRITERIA FOR SPECIFIC TYPES OF INFECTION

Infection criteria have been grouped into 14 major types with some further categorized into specific infections. For example, there are three specific types of central nervous system infections (intracranial infection, meningitis or ventriculitis, and spinal abscess without meningitis) that are grouped under the major type of CNS–Central Nervous System.

The specific and major types of infection used in NHSN and their abbreviated codes are listed inTable 1, in alphabetical order by major type code and the criteria for each of the specific types of infection follow it.

Table 1. CDC/NHSN Major and Specific Types of Healthcare-Associated Infections

BJ-BONE AND JOINT INFECTION

BONE-Osteomyelitis

Osteomyelitis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from bone.
2. Patient has evidence of osteomyelitis on gross anatomic or histopathologic exam.
3. Patient has at least ***two*** of the following localized signs or symptoms: fever (>38.0°C±), swelling*, pain or tenderness*, heat*, or drainage*
   And at least *one* of the following:
   a. organisms cultured from blood in a patient with imaging test evidence of infection
   b. positive non-culture diagnostic lab test on blood (e.g., antigen test, PCR)
   c. imaging test evidence of infection (e.g., x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc.])

** With no other recognized cause*
± As documented in the medical record

Reporting instruction
Report mediastinitis following cardiac surgery that is accompanied by osteomyelitis as SSI-MED rather than SSI-BONE

DISC-Disc space infection

Vertebral disc space infection must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from vertebral disc space.
2. Patient has evidence of vertebral disc space infection on gross anatomic or histopathologic exam.
3. Patient has at least ***one*** of the following: fever (>38.0°C±), pain at the involved vertebral disc space*
   And at least *one* of the following:
   a. organisms cultured from blood in a patient with imaging test evidence of infection
   b. positive non-culture diagnostic lab test on blood or urine (e.g., antigen test, PCR)
   c. imaging test evidence of infection (e.g., x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc.])

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JNT-Joint or bursa infection (not for use after HPRO or KPRO procedures)

Joint or bursa infections must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from joint fluid or synovial biopsy.
2. Patient has evidence of joint or bursa infection on gross anatomic or histopathologic exam.

3. Patient has at least ***two*** of the following signs or symptoms with no other recognized cause: swelling, pain or tenderness, heat, evidence of effusion, or limitation of motion.
   And at least *one* of the following:
   a. elevated joint fluid white blood cell count (per reporting laboratory's reference range) OR positive leukocyte esterase test strip of joint fluid
   b. organisms and white blood cells seen on Gram stain of joint fluid
   c. positive blood culture
   d. positive non-culture diagnostic lab test on blood, urine, or joint fluid (e.g., antigen test, PCR)
   e. imaging test evidence of infection (e.g., x-ray, CT scan, MRI, radiolabel scan [gallium, technetium, etc.])

PJI – Periprosthetic Joint Infection (following HPRO and KPRO only)

Joint or bursa infections must meet at least ***one*** of the following criteria:

1. ***Two*** positive periprosthetic (*tissue or fluid*) cultures with matching organisms.
2. A sinus tract communicating with the joint.
3. Having ***three*** of the following minor criteria:
   a. elevated serum C-reactive protein (CRP; >100 mg/L) ***and*** erythrocyte sedimentation rate (ESR; >30 mm/hr)
   b. elevated synovial fluid white blood cell (WBC; >10,000 cells/μL) count *OR* ++ (*or greater)* change on leukocyte esterase test strip of synovial fluid
   c. elevated synovial fluid polymorphonuclear neutrophil percentage (PMN% >90%)
   d. positive histological analysis of periprosthetic tissue (>5 neutrophils (PMNs) per high power field)
   e. a single positive periprosthetic (*tissue or fluid*) culture

COMMENTS

- A matching organism is defined as one of the following:
  - If genus and species are identified in both cultures, they must be the same.
    Example: Two joint fluid cultures reported as *Enterobacter cloacae* is a match.
    Example: A joint tissue culture reported as *Enterobacter cloacae* and a synovial fluid culture reported as *Enterobacter aerogenes* are NOT matching organisms as the species are different.
    Example: Two joint fluid cultures reported as *Enterococcus species* are considered matching organisms.
  - If the organism is less definitively identified in one culture than the other, the identifications must be complementary.
    Example: A joint fluid culture reported as *Pseudomonas spp*. and a joint tissue culture reported as *Pseudomonas aeruginosa* are considered a match at the genus level and therefore can be considered matching organisms.
    Note: Organisms do not have to have matching antibiograms.
- Positive cultures of hardware from a hip or knee can be used to meet criterion 1.
- A sinus tract is defined as a narrow opening or passageway underneath the skin that can extend in any direction through soft tissue and results in dead space with potential for abscess formation.

- The NHSN definition of PJI is closely adapted from the Musculoskeletal Infection Society's (MSIS's) definition of PJI (*Proceedings of the International Consensus Meeting on Periprosthetic Joint Infection, 2013*).
- The standard laboratory cutoff values in criteria 3a - 3d are provided by NHSN for HPRO and KPRO SSI surveillance purposes only. The NHSN laboratory cutoffs are not intended to guide clinicians in the actual clinical diagnosis and management of acute or chronic PJI. Clinicians should refer to the MSIS consensus definition for clinical use.

CNS-CENTRAL NERVOUS SYSTEM INFECTION

IC-Intracranial infection (brain abscess, subdural or epidural infection, encephalitis)

Intracranial infection must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from brain tissue or dura.
2. Patient has an abscess or evidence of intracranial infection on gross anatomic or histopathologic exam.
3. Patient has at least ***two*** of the following signs or symptoms: headache*, dizziness*, fever (>38.0°C[±]), localizing neurologic signs*, changing level of consciousness*, or confusion*
   And at least *one* of the following:
   a. organisms seen on microscopic examination of brain or abscess tissue obtained by needle aspiration or during an invasive procedure or autopsy
   b. positive non culture diagnostic laboratory test on blood or urine (e.g., antigen test, PCR)
   c. imaging test evidence of infection, (e.g., ultrasound, CT scan MRI, radionuclide brain scan, or arteriogram)
   d. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism
4. Patient ≤1 year of age has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), hypothermia (<36.0°C[±]), apnea*, bradycardia*, localizing neurologic signs*, or changing level of consciousness* (e.g., irritability, poor feeding, lethargy)
   And at least *one* of the following:
   a. organisms seen on microscopic examination of brain or abscess tissue obtained by needle aspiration or during an invasive procedure or autopsy
   b. positive non culture diagnostic laboratory test on blood or urine (e.g., antigen test, PCR)
   c. imaging test evidence of infection, (e.g., ultrasound, CT scan, MRI, radionuclide brain scan, or arteriogram)
   d. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism

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[±] As documented in the medical record

Reporting instructions

- Report as MEN if meningitis (MEN) and encephalitis (IC) are present together.
- Report as IC if meningitis (MEN) and a brain abscess (IC) are present together after operation.
- Report as SA if meningitis and spinal abscess (SA) are present together after an operation.

MEN-Meningitis or ventriculitis

Meningitis or ventriculitis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from cerebrospinal fluid (CSF).
2. Patient has at least ***two*** of the following
   i. fever (>38.0°C[±]) or headache (Note: Elements of "i" alone may not be used to meet the two required elements)
   ii. meningeal signs*
   iii. cranial nerve signs*

   And at least *one* of the following:
   a. increased white cells, elevated protein, and decreased glucose in CSF (per reporting laboratory's reference range)
   b. organisms seen on Gram stain of CSF
   c. organisms cultured from blood
   d. positive non culture diagnostic laboratory test of CSF, blood, or urine
   e. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism
3. Patient ≤1 year of age has at least ***two*** of the following elements:
   i. Fever (>38.0°C[±]), hypothermia (<36.0°C[±]), apnea, bradycardia, or irritability (Note: Elements of "i" alone may not be used to meet the required two elements).
   ii. meningeal signs*
   iii. cranial nerve signs*

   And at least *one* of the following:
   a. increased white cells, elevated protein, and decreased glucose in CSF (per reporting laboratory's reference range)
   b. organisms seen on Gram stain of CSF
   c. organisms cultured from blood
   d. positive non culture diagnostic laboratory test of CSF, blood, or urine
   e. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism

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Reporting instructions

- Report meningitis in the newborn as healthcare associated unless there is compelling evidence indicating the meningitis was acquired transplacentally (i.e., unless it was apparent on the day of birth or the next day).
- Report CSF shunt infection as SSI-MEN if it occurs within 90 days of placement; if later or after manipulation/access, it is considered CNS-MEN and is not reportable under this module.
- Report as ME if meningitis (MEN) and encephalitis (IC) are present together.
- Report as IC if meningitis (MEN) and a brain abscess (IC) are present together after operation.
- Report as SA if meningitis and spinal abscess (SA) are present together after an operation.

SA-Spinal abscess without meningitis

An abscess of the spinal epidural or subdural space, without involvement of the cerebrospinal fluid or adjacent bone structures, must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from abscess in the spinal epidural or subdural space.
2. Patient has an abscess in the spinal epidural or subdural space on gross anatomic or histopathologic exam.
3. Patient has at least ***one*** of the following localized signs or symptoms: fever (>38.0°C[±]), back pain* or tenderness*, radiculitis*, paraparesis*, or paraplegia*
   And at least *one* of the following:
   a. organisms cultured from blood in a patient with imaging test evidence of spinal abscess
   b. imaging test evidence of a spinal abscess (e.g., myelography, ultrasound, CT scan, MRI, or other scans [gallium, technetium, etc.])

** With no other recognized cause*
[±] As documented in the medical record

Reporting instructions

- Report as IC if meningitis (MEN) and a brain abscess (IC) are present together after operation.
- Report as SA if meningitis and spinal abscess (SA) are present together after an operation.

CVS-CARDIOVASCULAR SYSTEM INFECTION

CARD-Myocarditis or pericarditis

Myocarditis or pericarditis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from pericardial tissue or fluid.
2. Patient has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), chest pain*, paradoxical pulse*, or increased heart size*
   And at least *one* of the following:
   a. abnormal EKG consistent with myocarditis or pericarditis
   b. positive non-culture diagnostic lab test on blood (e.g., antigen test, PCR)
   c. evidence of myocarditis or pericarditis on histologic exam of heart tissue
   d. 4-fold rise in paired sera from IgG antibody titer
   e. pericardial effusion identified by echocardiogram, CT scan, MRI, or angiography
3. Patient ≤1 year of age has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), hypothermia (<36.0°C[±]), apnea*, bradycardia*, paradoxical pulse*, or increased heart size*
   And at least *one* of the following:
   a. abnormal EKG consistent with myocarditis or pericarditis
   b. positive non-culture lab test on blood (e.g., antigen test, PCR)
   c. histologic examination of heart tissue shows evidence of myocarditis or pericarditis
   d. 4-fold rise in paired sera from IgG antibody titer
   e. pericardial effusion identified by echocardiogram, CT scan, MRI, or angiography

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[±] As documented in the medical record

Comment: Most cases of post cardiac surgery or post myocardial infarction pericarditis are not infectious.

ENDO-Endocarditis

Endocarditis of a natural or prosthetic heart valve must meet at least ***one*** of the following criteria:

1. Organisms cultured from cardiac vegetation*, embolized vegetation (e.g., solid organ abscess) documented as originating from cardiac source, or intracardiac abscess.
2. Organisms seen on histopathologic examination of cardiac vegetation, embolized vegetation (e.g., solid organ abscess) documented as originating from cardiac source, or intracardiac abscess.
3. Endocarditis seen on histopathologic examination of cardiac vegetation or intracardiac abscess.
4. At least ***one*** of the following echocardiographic evidence of endocarditis:
    i. vegetation on cardiac valve or supporting structures
    ii. intracardiac abscess
    iii. new partial dehiscence of prosthetic valve

    And at least *one* of the following:
    a. typical infectious endocarditis organisms (i.e., Viridans group streptococci, *Streptococcus bovis*, *Haemophilus* spp., *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Kingella* spp., *Staphylococcus aureus*) from ≥2 blood cultures drawn on separate occasions (on same or consecutive days)
    b. *Coxiella burnetii* cultured from blood or identified by anti-phase I IgG antibody titer >1:800
5. At least ***three*** of the following:
    i. prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use
    ii. fever (>38.0°C$^{\pm}$)
    iii. vascular phenomena: major arterial emboli (i.e., embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen, intracranial hemorrhage, conjunctival hemorrhages, or Janeway's lesions documented
    iv. immunologic phenomena: glomuleronephritis (documented or chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor.

    And at least *one* of the following:
    a. typical infectious endocarditis organisms (i.e., Viridans group streptococci, *Streptococcus bovis*, *Haemophilus* spp., *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Kingella* spp., *Staphylococcus aureus*) from ≥2 blood cultures drawn on separate occasions (on same or consecutive days)
    b. *Coxiella burnetii* cultured from blood or identified by anti-phase I IgG antibody titer >1:800
6. At least ***one*** of the following:
    i. vegetation on cardiac valve or supporting structures seen on echocardiogram
    ii. intracardiac abscess seen on echocardiogram
    iii. new partial dehiscence of prosthetic valve seen on echocardiogram

    And at least *three* of the following:

a. prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use
b. fever (>38.0°C[±])
c. vascular phenomena: major arterial emboli (i.e., embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen, intracranial hemorrhage, conjunctival hemorrhages, or Janeway's lesions documented
d. immunologic phenomena: glomuleronephritis (documented in chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor
e. identification of an organism from the blood by at least ***one*** of the following methods:
    - recognized pathogen cultured from one or more blood cultures,
    - same common commensal organism cultured from ≥2 blood cultures drawn on separate occasions (on same or consecutive days), or
    - organism identified by non-culture diagnostic test from blood (e.g., serology, PCR)

7. All of the following criteria:
    a. prior endocarditis, prosthetic valve, uncorrected congenital heart disease, history of rheumatic heart disease, hypertrophic obstructive cardiomyopathy, or known IV drug use
    b. fever (>38.0°C[±])
    c. vascular phenomena: major arterial emboli (i.e., embolic stroke, renal infarct, splenic infarct or abscess, digital ischemic/gangrene from embolic source), septic pulmonary infarcts, mycotic aneurysm (documented by imaging, seen in surgery, or described in gross pathological specimen, intracranial hemorrhage, conjunctival hemorrhages, or Janeway's lesions documented
    d. immunologic phenomena: glomuleronephritis (documented or chart, or white cell or red blood cell casts on urinalysis), Osler's nodes, Roth's spots, or positive rheumatoid factor
    e. identification of an organism from the blood by at least ***one*** of the following methods:
        - recognized pathogen cultured from one or more blood cultures,
        - name common commensal organism cultured from ≥2 blood cultures drawn on separate occasions (on same or consecutive days), or
        - organism identified by non-culture diagnostic test from blood (e.g., serology, PCR)

* *With no other recognized cause*
[±] *As documented in the medical record*

Reporting instruction
"Cardiac vegetation" includes vegetation on a pacemaker/ defibrillator lead.

MED-Mediastinitis

Mediastinitis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from mediastinal tissue or fluid.
2. Patient has evidence of mediastinitis on gross anatomic or histopathologic exam.

3. Patient has at least ***one*** of the following signs or symptoms: fever (>38.0°C[±]), chest pain*, or sternal instability*
   And at least *one* of the following:
   a. purulent drainage from mediastinal area
   b. mediastinal widening on imaging test
4. Patient ≤1 year of age has at least ***one*** of the following signs or symptoms: fever (>38.0°C[±]), hypothermia (<36.0°C[±]), apnea*, bradycardia*, or sternal instability*
   And at least *one* of the following:
   a. purulent drainage from mediastinal area
   b. mediastinal widening on imaging test

* *With no other recognized cause*
[±] *As documented in the medical record*

Reporting instruction
Report mediastinitis following cardiac surgery that is accompanied by osteomyelitis as SSI-MED rather than SSI-BONE.

VASC-Arterial or venous infection

Note: If a patient meets the criteria for an LCBI in the presence of an intravascular infection report as an LCBI not as a VASC.

Arterial or venous infection must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from extracted arteries or veins.
2. Patient has evidence of arterial or venous infection on gross anatomic or histopathologic exam.
3. Patient has at least ***one*** of the following signs or symptoms: fever (>38.0°C[±]), pain*, erythema*, or heat at involved vascular site*
   AND
   More than 15 colonies cultured from intravascular cannula tip using semiquantitative culture method.
4. Patient has purulent drainage at involved vascular site.
5. Patient ≤1 year of age has at least ***one*** of the following signs or symptoms: fever (>38.0°C[±]), hypothermia (<36.0°C[±]), apnea*, bradycardia*, lethargy*, pain*, erythema*, or heat at involved vascular site*
   AND
   More than 15 colonies cultured from intravascular cannula tip using semiquantitative culture method.

* *With no other recognized cause*
[±] *As documented in the medical record*

Reporting instructions
- Report infections of an arteriovenous graft, shunt, fistula or intravascular cannulation site without organisms cultured from blood as CVS-VASC.

- Report intravascular infections with organisms cultured from the blood and meeting the LCBI criteria, as BSI-LCBI.
- Report Organ Space VASC infections as an SSI and not an LCBI when you have a SSI with secondary BSI.

EENT-Eye, ear, nose throat, or mouth infection

CONJ-Conjunctivitis

Conjunctivitis must meet at least ***one*** of the following criteria:

1. Patient has organism(s) cultured from purulent exudate obtained from the conjunctiva or contiguous tissues, (e.g., eyelid, cornea, meibomian glands, or lacrimal glands).
2. Patient has pain or redness of conjunctiva or around eye.
   And at least *one* of the following:
   a. WBCs and organisms seen on Gram stain of exudate
   b. purulent exudate
   c. positive non culture diagnostic laboratory test on exudate or conjunctival scraping (e.g., antigen tests such as ELISA or IF for Chlamydia trachomatis, herpes simplex virus, adenovirus)
   d. multinucleated giant cells seen on microscopic examination of conjunctival exudate or scrapings
   e. positive viral culture on exudate or conjunctival scraping
   f. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism

Reporting instructions

- Report other infections of the eye as EYE.
- Do not report chemical conjunctivitis, caused by silver nitrate ($AgNO_3$), as a healthcare–associated infection.
- Do not report a separate case of conjunctivitis that occurs as a part of another viral illness (e.g., URI).

EAR-Ear, mastoid infection

Ear and mastoid infections must meet at least ***one*** of the following criteria:

Otitis externa must meet at least ***one*** of the following criteria:

1. Patient has organism(s) cultured from purulent drainage from ear canal.
2. Patient has at least ***one*** of the following localized signs or symptoms: fever (>38.0°C$^{\pm}$), pain*, erythema*, ***and*** organism(s) seen on Gram stain of purulent drainage from ear canal.

Otitis media must meet at least ***one*** of the following criteria:

3. Patient has organism(s) cultured from fluid from middle ear obtained during an invasive procedure, e.g., tympanocentesis.
4. Patient has at least ***two*** of the following localized signs or symptoms: fever (>38.0°C$^{\pm}$), pain *, inflammation*, retraction* or decreased mobility of eardrum*, or fluid behind eardrum*.

Otitis interna must meet at least ***one*** of the following criteria:

5. Patient has organism(s) cultured from fluid from inner ear obtained during an invasive procedure.
6. Patient has a physician diagnosis of inner ear infection.

Mastoiditis must meet at least ***one*** of the following criteria:

7. Patient has organism(s) cultured from fluid or tissue from mastoid.
8. Patient has at least ***two*** of the following localized signs or symptoms: fever (>38.0°C[±]), pain or tenderness*, post auricular swelling*, erythema*, headache*, or facial paralysis*
   And at least *one* of the following:
   a. organism(s) seen on Gram stain of fluid or tissue from mastoid
   b. positive non-culture diagnostic lab test on fluid or tissue from mastoid (e.g., antigen test, PCR)
   c. imaging test evidence of infection (e.g., CT scan)

** With no other recognized cause*
[±] As documented in the medical record

EYE-Eye infection, other than conjunctivitis

An infection of the eye, other than conjunctivitis, must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from anterior or posterior chamber or vitreous fluid.
2. Patient has at least ***two*** of the following signs or symptoms with no other recognized cause : eye pain, visual disturbance, or hypopyon
   And at least *one* of the following:
   a. physician initiates antimicrobial therapy within ***two*** days of onset or worsening of symptoms
   b. positive non-culture diagnostic laboratory test on blood (e.g., antigen test, PCR)

ORAL-Oral cavity infection (mouth, tongue, or gums)

Oral cavity infections must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from either abscess or purulent material from tissues of oral cavity.
2. Patient has an abscess or other evidence of oral cavity infection found on invasive procedure, gross anatomic exam, or histopathologic exam.
3. Patient has at least ***one*** of the following signs or symptoms with no other recognized cause: ulceration, raised white patches on inflamed mucosa, or plaques on oral mucosa
   And at least *one* of the following:
   a. positive non-culture diagnostic laboratory test on mucosal scrapings or exudate (e.g., antigen test, PCR)
   b. multinucleated giant cells seen on microscopic examination of mucosal scrapings or exudate
   c. positive viral culture on mucosal scrapings or exudate
   d. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism
   e. fungal elements seen on microscopic exam of mucosal scrapings or exudate (e.g., Gram stain, KOH)
   f. physician initiates antimicrobial therapy within 2 days of onset or worsening of symptoms

Reporting instruction
Report healthcare–associated primary herpes simplex infections of the oral cavity as ORAL; recurrent herpes infections are not healthcare associated.

SINU-Sinusitis

Sinusitis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from fluid or tissue from the sinus cavity obtained during an invasive procedure.
2. Patient has at least ***one*** of the following signs or symptoms: fever (>38.0°C[±]), pain or tenderness over the involved sinus*, headache*, purulent exudate*, or nasal obstruction*
   AND
   Imaging test evidence of sinusitis (e.g., x-ray, CT scan)

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[±] As documented in the medical record

UR-Upper respiratory tract infection, pharyngitis, laryngitis, epiglottitis

Upper respiratory tract infections must meet at least ***one*** of the following criteria:

1. Patient has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), erythema of pharynx*, sore throat*, cough*, hoarseness*, or purulent exudate in throat*
   And at least *one* of the following:
   a. organisms cultured from upper respiratory site [i.e. larynx, pharynx, and epiglottis] (Note: excludes sputum because sputum is not an upper respiratory specimen)
   b. positive non-culture diagnostic laboratory test from upper respiratory site [i.e. larynx, pharynx, and epiglottis] (Note: excludes sputum because sputum is not an upper respiratory specimen)
   c. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism
   d. physician diagnosis of an upper respiratory infection
2. Patient has an abscess on gross anatomical or histopathologic exam or imaging test.
3. Patient ≤1 year of age has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), hypothermia (<37.0°C[±]), apnea*, bradycardia*, nasal discharge*, or purulent exudate in throat*
   And at least *one* of the following:
   a. organisms cultured from upper respiratory site [i.e. larynx, pharynx, and epiglottis] (Note: excludes sputum because sputum is not an upper respiratory specimen)
   b. positive non-culture diagnostic laboratory test from upper respiratory site [i.e. larynx, pharynx, and epiglottis] (Note: excludes sputum because sputum is not an upper respiratory specimen)
   c. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism
   d. physician diagnosis of an upper respiratory infection

** With no other recognized cause*
[±] As documented in the medical record

GI-GASTROINTESTINAL SYSTEM INFECTION

CDI-*Clostridium difficile* Infection

Clostridium difficile infection must meet at least ***one*** of the following criteria:

1. Positive test for toxin-producing *C. difficile* on an unformed stool specimen (conforms to the shape of the container).[1] (see Reporting instructions)
2. Patient has evidence of pseudomembranous colitis on gross anatomic (includes endoscopic exams) or histopathologic exam.

Reporting instructions

- Report the CDI and the GE or GIT if additional enteric organisms are identified and criteria are met for GE or GIT.
- Report each new GI-CDI according to the Repeat Infection Timeframe (RIT) rule for HAIs (see NHSN HAI definitions in Chapter 2 for further details and guidance).
- CDI laboratory-identified event (LabID Event) categorizations (e.g., recurrent CDI assay, incident CDI assay, healthcare facility-onset, community-onset, community-onset healthcare facility-associated) do **not** apply to HAIs; including *C. difficile* associated gastrointestinal infections (GI-CDI).
- McDonald, LC., Coignard, B., Dubberke, E., Song, X., Horan, T., Kutty, PK. "Recommendations for surveillance of Clostridium difficile-associated disease." Infection Control Hospital Epidemiology, 28: (2007): 140-5.

GE-Gastroenteritis (excluding *C. difficile* infections)

Gastroenteritis must meet at least ***one*** of the following criteria:

1. Patient has an acute onset of diarrhea (liquid stools for > 12 hours) and no likely noninfectious cause (e.g., diagnostic tests, therapeutic regimen other than antimicrobial agents, acute exacerbation of a chronic condition, or psychological stress information).
2. Patient has at least ***two*** of the following signs or symptoms: nausea*, vomiting*, abdominal pain*, fever (>38.0°C[±]), or headache*
   And at least *one* of the following:
   a. an enteric pathogen is cultured from stool or rectal swab
   b. an enteric pathogen is detected by microscopy
   c. an enteric pathogen is detected by antigen or antibody assay on blood or feces
   d. evidence of an enteric pathogen is detected by cytopathic changes in tissue culture
   e. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism

** With no other recognized cause*
[±] As documented in the medical record

Reporting instruction

- Report only GI-GIT using the event date as that of GI-GIT if the patient meets criteria for both GI-GE and GI-GIT.

GIT-Gastrointestinal tract infection (esophagus, stomach, small and large bowel, and rectum) excluding gastroenteritis, appendicitis, and *C. difficile* infection

Gastrointestinal tract infections, excluding, gastroenteritis and appendicitis, must meet at least ***one*** of the following criteria:

1. Patient has an abscess or other evidence of infection on gross anatomic or histopathologic exam of gastrointestinal tract.
2. Patient has at least ***two*** of the following localized signs or symptoms compatible with infection of the organ or tissue involved: fever (>38.0°C[±]), nausea*, vomiting*, pain*or tenderness*, odynophagia*, or dysphagia*
   And at least ***one* of the following:**
   a. organisms cultured from drainage or tissue obtained during an invasive procedure or from drainage from an aseptically-placed drain
   b. organisms seen on Gram stain or fungal elements seen on KOH stain or multinucleated giant cells seen on microscopic examination of drainage or tissue obtained during an invasive procedure or from drainage from an aseptically-placed drain
   c. organisms cultured from blood in a patient with imaging test evidence of gastrointestinal infection
   d. imaging test evidence of infection (e.g., MRI, CT Scan)
   e. evidence of infection on endoscopic examination (e.g., Candida esophagitis, proctitis, etc.)

** With no other recognized cause*
[±] As documented in the medical record

Reporting instruction
Report only GI-GIT using the event date as that of GI-GIT if the patient meets criteria for both GI-GE and GI-GIT

HEP-Hepatitis (acute)

Hepatitis must meet the following criterion:

1. Patient has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), anorexia*, nausea*, vomiting*, abdominal pain*, jaundice*, or history of transfusion within the previous three months
   And at least ***one* of the following:**
   a. positive laboratory test for acute hepatitis A, hepatitis B, hepatitis C, or delta hepatitis and duration of hospital stay consistent with healthcare acquisition
   b. cytomegalovirus (CMV) detected in urine or oropharyngeal secretions

** With no other recognized cause*
[±] As documented in the medical record

Reporting instructions
- Do not report hepatitis or jaundice of noninfectious origin (alpha-1 antitrypsin deficiency, etc.).
- Do not report hepatitis or jaundice that result from exposure to hepatotoxins (alcoholic or acetaminophen- induced hepatitis, etc.).
- Do not report hepatitis or jaundice that result from biliary obstruction (cholecystitis).

IAB-Intraabdominal infection, not specified elsewhere including gallbladder, bile ducts, liver (excluding viral hepatitis), spleen, pancreas, peritoneum, subphrenic or subdiaphragmatic space, or other intraabdominal tissue or area not specified elsewhere

Intraabdominal infections must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from abscess and/or purulent material from intraabdominal space.
2. Patient has abscess or other evidence of intraabdominal infection on gross anatomic or histopathologic exam.
3. Patient has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), nausea*, vomiting*, abdominal pain*, or jaundice*
   And at least *one* of the following:
   a. organisms seen on culture or Gram stain of drainage or tissue obtained during invasive procedure or from an aseptically-placed drain (e.g., closed suction drainage system, open drain, T-tube drain, CT guided drainage)
   b. organisms cultured from blood and imaging test evidence of infection (e.g., ultrasound, CT scan, MRI, radiolabel scans [gallium, technetium, etc.] or on abdominal x-ray)

** With no other recognized cause*
[±] As documented in the medical record

Reporting instruction
Do not report pancreatitis (an inflammatory syndrome characterized by abdominal pain, nausea, and vomiting associated with high serum levels of pancreatic enzymes) unless it is determined to be infectious in origin.

NEC-Necrotizing enterocolitis

Necrotizing enterocolitis in infants **(**≤1 year of age) must meet the following criteria:

1. Infant has at least ***one*** of the clinical and ***one*** of the imaging test findings from the lists below:
   At least *one* clinical sign:
   a. bilious aspirate****** (see **Note**)
   b. vomiting
   c. abdominal distention
   d. occult or gross blood in stools (with no rectal fissure)
   And at least *one* imaging test finding:
   a. Pneumatosis intestinalis
   b. Portal venous gas (Hepatobiliary gas)
   c. Pneumoperitoneum
   ****Note:** Bilious aspirate as a result of a transpyloric placement of a nasogastric tube should be excluded

2. Surgical NEC: Infant has at least ***one*** of the following surgical findings:
   a. surgical evidence of extensive bowel necrosis (>2 cm of bowel affected)
   b. surgical evidence of pneumatosis intestinalis with or without intestinal perforation

Reporting instruction

Since necrotizing enterocolitis (NEC) criteria include neither a site specific culture nor a positive blood culture, an **exception** for assigning a BSI secondary to NEC is provided. A BSI is considered secondary to NEC if the patient meets one of the two NEC criteria **AND** a positive blood culture(s) collected during the secondary BSI attribution period is positive for an LCBI pathogen or the same common commensal is cultured from two or more blood cultures drawn on separate occasions collected on the same or consecutive days.

LRI- LOWER RESPIRATORY INFECTION, OTHER THAN PNEUMONIA

LUNG-Other infection of the lower respiratory tract

Other infections of the lower respiratory tract must meet at least ***one*** of the following criteria:

1. Patient has organisms seen on smear or cultured from lung tissue or pleural fluid (when pleural fluid was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube).
2. Patient has a lung abscess or other evidence of infection (e.g., empyema) on gross anatomic or histopathologic exam.
3. Patient has imaging test evidence of abscess or infection.

Reporting instructions
If patient meets LUNG and PNEU report as PNEU only, unless the LUNG is a surgical site organ/space infection, in which case, report both PNEU and SSI-LUNG.

REPR-REPRODUCTIVE TRACT INFECTION

EMET-Endometritis

Endometritis must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from endometrial fluid or tissue (including amniotic fluid).
2. Patient has at least ***two*** of the following signs or symptoms: fever (>38.0°C[±]), pain or tenderness (uterine or abdominal)*, or purulent drainage from uterus.

** With no other recognized cause*
[±] As documented in the medical record

Reporting instruction

- Do not report an HAI chorioamnionitis as EMET (see OREP).
- Do not report subsequent postpartum endometritis after a vaginal delivery as an HAI if a patient is admitted with POA chorioamnionitis (OREP). (See next bullet for endometritis following a C-section).
- Report as an organ space SSI-EMET if a C-section was performed on a patient with chorioamnionitis, and the patient later develops endometritis.

EPIS-Episiotomy infection

Episiotomy infections must meet at least ***one*** of the following criteria:

1. Postvaginal delivery patient has purulent drainage from the episiotomy.
2. Postvaginal delivery patient has an episiotomy abscess.

Comment: Episiotomy is not considered an operative procedure in NHSN.

OREP-Other infection of the male or female reproductive tract (epididymis, testes, prostate, vagina, ovaries, uterus, chorioamnionitis, or other deep pelvic tissues, excluding endometritis or vaginal cuff infections)

Other infections of the male or female reproductive tract must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from tissue or fluid from affected site (excludes urine).
2. Patient has an abscess or other evidence of infection of affected site on gross anatomic or histopathologic exam.
3. Patient has ***two*** of the following localized signs or symptoms: fever (>38.0°C[±]), nausea*, vomiting*, pain or tenderness*, or dysuria*
   And at least *one* of the following:
   a. organisms cultured from blood
   b. physician initiates antimicrobial therapy within ***two*** days of onset or worsening of symptoms

** With no other recognized cause*
[±] As documented in the medical record

Reporting instructions

- Report endometritis as EMET.
- Report vaginal cuff infections as VCUF.
- If patient has epididymitis, prostatitis, or orchitis and meets OREP criteria, and they also meet UTI criteria, report UTI only, unless the OREP is a surgical site organ/space infection, in which case, only OREP should be reported.

VCUF-Vaginal cuff infection

Vaginal cuff infections must meet at least ***one*** of the following criteria:

1. Post hysterectomy patient has purulent drainage from the vaginal cuff on gross anatomic exam.
2. Post hysterectomy patient has an abscess at the vaginal cuff on gross anatomic exam.
3. Post hysterectomy patient has pathogens cultured from fluid or tissue obtained from the vaginal cuff.

Reporting instruction

- Report vaginal cuff infections as SSI-VCUF.

SST-SKIN AND SOFT TISSUE INFECTION

BRST-Breast abscess or mastitis

A breast abscess or mastitis must meet at least ***one*** of the following criteria:

1. Patient has a positive culture of affected breast tissue or fluid obtained by invasive procedure.
2. Patient has a breast abscess or other evidence of infection on gross anatomic or histopathologic exam.
3. Patient has fever (>38.0°C[±]) and local inflammation of the breast,
   AND
   Physician initiates antimicrobial therapy within 2 days of onset or worsening of symptoms.

[±] *As documented in the medical record*

Reporting instruction
For SSI after a BRST procedure: if the infection is in the subcutaneous region report as a superficial incisional SSI, and if the infection involves the muscle/fascial level report as a deep incisional SSI.

BURN-Burn infection

Burn infections must meet the following criteria:

1. Patient has a change in burn wound appearance or character, such as rapid eschar separation, or dark brown, black, or violaceous discoloration of the eschar,
   AND
   Organisms cultured from blood in the absence of other identifiable infection.

CIRC-Newborn circumcision infection

Circumcision infection in a newborn (≤30 days old) must meet at least ***one*** of the following criteria:

1. Newborn has purulent drainage from circumcision site.
2. Newborn has at least ***one*** of the following signs or symptoms with no other recognized cause at circumcision site: erythema, swelling, or tenderness,
   AND
   Pathogen cultured from circumcision site.
3. Newborn has at least ***one*** of the following signs or symptoms with no other recognized cause at circumcision site: erythema, swelling, or tenderness,
   AND
   Common commensal is cultured from circumcision site,
   AND
   Physician initiates antimicrobial therapy within ***two*** days on onset or worsening of symptoms.

DECU-Decubitus ulcer infection, including both superficial and deep infections

Decubitus ulcer infections must meet the following criterion:

1. Patient has at least ***two*** of the following signs or symptoms with no other recognized cause: erythema, tenderness, or swelling of decubitus wound edges,
   AND
   Organisms cultured from needle aspiration of fluid or biopsy of tissue from ulcer margin.

SKIN-Skin infection (skin and /or subcutaneous)

Skin infections must meet at least ***one*** of the following criteria:

1. Patient has purulent drainage, pustules, vesicles, or boils (excluding acne).
2. Patient has at least ***two*** of the following localized signs or symptoms with no other recognized cause: pain or tenderness, swelling, erythema, or heat
   And at least *one* of the following*:*
   a. organisms cultured from aspirate or drainage from affected site (not a common commensal); if only organism is a common commensal (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), it must be a pure culture (single organism identified)
   b. positive non-culture diagnostic lab test performed on infected tissue or blood (e.g., antigen test, PCR)
   c. multinucleated giant cells seen on microscopic examination of affected tissue
   d. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism

Reporting instructions

- Do not report acne as a skin/soft tissue HAI.
- Report omphalitis in infants as UMB.
- Report infections of the circumcision site in newborns as CIRC.
- Report pustules in infants as PUST.
- Report infected decubitus ulcers as DECU.
- Report infected burns as BURN.
- Report breast abscesses or mastitis as BRST.
- Report localized infection at a vascular access site as a VASC unless there is a positive blood culture meeting LCBI criteria, which should instead be reported as an LCBI (see VASC definition).

ST-Soft tissue infection (muscle and/or fascia [e.g., necrotizing fasciitis, infectious gangrene, necrotizing cellulitis, infectious myositis, lymphadenitis, or lymphangitis])

Soft tissue infections must meet at least ***one*** of the following criteria:

1. Patient has organisms cultured from tissue or drainage from affected site.
2. Patient has purulent drainage at affected site.
3. Patient has an abscess or other evidence of infection on gross anatomic or histopathologic exam.

Reporting instructions

- Report infected decubitus ulcers as DECU.
- Report infection of deep pelvic tissues as OREP.
- Report localized infection at a vascular access site as a VASC unless there is a positive blood culture then it should be reported as an LCBI (see VASC definition).

UMB-Oomphalitis

Omphalitis in a newborn (≤30 days old) must meet at least ***one*** of the following criteria:

1. Patient has erythema or serous drainage from umbilicus
   And at least *one* of the following:
   a. organisms cultured from drainage or needle aspirate
   b. organisms cultured from blood
2. Patient has erythema and purulence at the umbilicus.

Reporting instructions

Report infection of the umbilical artery or vein related to umbilical catheterization as VASC if there is no accompanying blood culture or a blood culture is negative. If the patient meets criteria for LCBI, report as a LCBI (see VASC).

USI – Urinary System Infection [formerly OUTI] (kidney, ureter, bladder, urethra, or tissue surrounding the retroperitoneal or perinephric space)

Urinary system infection infections must meet at least ***one*** of the following criteria:

1. Patient has microorganisms isolated from culture of fluid (not urine) or tissue from affected site.
2. Patient has an abscess or other evidence of infection on gross anatomical exam, during invasive procedure, or on histopathologic exam.
3. Patient has ***one*** of the following signs or symptoms: fever (>38.0°C), localized pain or tenderness*.
   And at least *one* of the following:
   a. purulent drainage from affected site
   b. organisms cultured from blood and imaging test evidence of infection (e.g., ultrasound, CT scan, magnetic resonance imaging [MRI], or radiolabel scan [gallium, technetium]).
4. Patient ≤1 year of age has at least ***one*** of the following signs or symptoms: fever (>38.0°C), hypothermia (<36.0°C), apnea*, bradycardia*, lethargy*, or vomiting*
   And at least *one* of the following:
   a. purulent drainage from affected site
   b. organisms cultured from blood and imaging test evidence of infection, (e.g., ultrasound, CT scans, magnetic resonance imaging [MRI], or radiolabel scan [gallium, technetium])

** With no other recognized cause*

Reporting instructions

- Report infections following circumcision in newborns as SST-CIRC.

- If patient meets USI criteria and they also meet UTI criteria, report UTI only, unless the USI is a surgical site organ/space infection, in which case, only USI should be reported.

REFERENCES

[1]McDonald, LC., Coignard, B., Dubberke, E., Song, X., Horan, T., Kutty, PK. "Recommendations for surveillance of Clostridium difficile-associated disease." *Infection Control Hospital Epidemiology*, 28: (2007): 140-5.

Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central line-associated Bloodstream Infection)

Introduction: An estimated 30,100 central line-associated bloodstream infections (CLABSI) occur in intensive care units and wards of U.S. acute care facilities each year.[1] These infections are usually serious infections typically causing a prolongation of hospital stay and increased cost and risk of mortality.

CLABSI can be prevented through proper insertion techniques and management of the central line. These techniques are addressed in the CDC's Healthcare Infection Control Practices Advisory Committee (CDC/HIPAC) *Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011*.[2]

Settings: Surveillance may occur in any inpatient location where denominator data can be collected, which can include critical/intensive care units (ICU), specialty care areas (SCA), neonatal units including neonatal intensive care units (NICUs), step down units, wards, and long term care units. A complete listing of inpatient locations and instructions for mapping can be found in the CDC Locations and Descriptions chapter.

Note: Surveillance for CLABSIs after the patient is discharged from the facility is not required. However, if discovered, any CLABSIs with a date of event on the day of discharge or the next day should be reported to NHSN (see Transfer Rule). No additional central line days are reported.

Definitions:

Present on Admission (POA): Infections that are POA, as defined in Chapter 2, are not considered HAIs and therefore are never reported to NHSN.

Healthcare-associated infections (HAI): All NHSN site specific infections must first meet the HAI definition as defined in Chapter 2 before a site specific infection (e.g., CLABSI) can be reported to NHSN.

Primary bloodstream infections (BSI): Laboratory-confirmed bloodstream infections (LCBI) that are not secondary to an infection at another body site (see Appendix 1. Secondary Bloodstream Infection (BSI) Guide and Surveillance Definitions chapter).

Date of event (DOE): For a BSI the date of event is the date when the FIRST element used to meet the laboratory-confirmed bloodstream infection (LCBI) criterion occurred. Synonym: infection date.

Central line: An intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. The following are considered great vessels for the purpose of reporting central-line BSI and counting central-line days in the NHSN system:

- Aorta
- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Brachiocephalic veins
- Internal jugular veins
- Subclavian veins
- External iliac veins
- Common iliac veins
- Femoral veins
- In neonates, the umbilical artery/vein.

Notes:

1. Neither the insertion site nor the type of device may be used to determine if a line qualifies as a central line. The device must terminate in one of the great vessels or in or near the heart, and be used for one of the purposes outlined above, to qualify as a central line.
2. At times an intravascular line may migrate from its original great vessel location. Subsequent to the original confirmation, NHSN does not require ongoing confirmation that a line resides in a great vessel. Therefore, once a line is identified to be a central line for NHSN purposes, it is considered a central line until discontinuation, regardless of migration.
3. An introducer is considered an intravascular catheter, and depending on the location of its tip and use, may be a central line.
4. Pacemaker wires and other non-lumened devices inserted into central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.
5. The following devices are not considered central lines:
    - Extracorporeal membrane oxygenation (ECMO)
    - Femoral arterial catheters
    - Intra-aortic balloon pump (IABP) devices.
    - Hemodialysis reliable outflow (HeRO) dialysis catheters

Infusion: The introduction of a solution through a blood vessel via a catheter lumen. This may include continuous infusions such as nutritional fluids or medications, or it may include intermittent infusions such as flushes, IV antimicrobial administration, or blood transfusion or hemodialysis.

Umbilical catheter: A central vascular device inserted through the umbilical artery or vein in a neonate.

Temporary central line: A non-tunneled, non- implanted catheter.
Permanent central line: Includes

- Tunneled catheters, including certain dialysis catheters
- Implanted catheters (including ports)

Central line-associated BSI (CLABSI): A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) or umbilical catheter (UC) was in place for >2 calendar days on the date of event, with day of device placement being Day 1,

AND

a CL or UC was in place on the date of event or the day before. If a CL or UC was in place for >2 calendar days and then removed, the date of event of the LCBI must be the day of discontinuation or the next day. If the patient is admitted or transferred into a facility with an implanted central line (port) in place, and that is the patient's only central line, day of first access in an inpatient location is considered Day1. "Access" is defined as line placement, infusion or withdrawal through the line. Such lines continue to be eligible for CLABSI once they are accessed until they are either discontinued or the day after patient discharged (as per the Transfer Rule). Note that the "de-access" of a port does not result in the patient's removal from CLABSI surveillance.

Examples of Determining a CLABSI verses BSI

- Patient in MICU has central line inserted/accessed on June 1. On June 3, the central line is still in place and the patient has positive blood culture with *S. aureus*. This is a CLABSI because the central line was in place for >2 calendar days (June 1, 2, and 3) on the date of event (June 3).
- Patient has a central line inserted on June 1. On June 3, the central line is removed and on June 4 the patient has a positive blood culture with *S. aureus*. This is a CLABSI because the central line was in place for >2 calendar days (June 1, 2, and 3), and was in place the day before the date of event (June 4).
- A central line is placed in the facility on May 30th. On June 3, the central line is removed and on June 5 patient spikes a fever of 38.3°C. Two blood culture sets collected on June 6 are positive for *S. epidermidis*. This is may be a healthcare-associated bloodstream infection but it is not a CLABSI because the Date of Event (June 5) did not occur on the day the central line was discontinued (June 3) or the next day (June 4)

Notes:

- **Central lines that are removed and reinserted**: If, after central line removal, the patient is without a central line for at least one full calendar day (NOT to be read as 24 hours), then the central line day count will start anew. If instead, a new central line is inserted before a full calendar day without a central line has passed, the central line day count will continue. See Figure 1 below.

- Bloodstream infections will not be reported if they occur within the Repeat Infection Timeframe of a previously identified BSI. See Repeat Infection Timeframe guidance in Chapter 2, Identifying HAIs.
- Patients suspected or known to have accessed their own IV lines are **not** excluded from CLABSI surveillance. A facility must protect the line as best they can. Prevention efforts may include providing a patient sitter and/or removal of the catheter as soon as is clinically possible.

Figure 1: Associating Central Line (CL) Use to BSI

	March 31 (Hospital day 3)	April 1	April 2	April 3	April 4	April 5	April 6
Patient A	Central Line **Day 3**	Central Line **Day 4**	Central Line removed **(CL Day 5)**	Central Line replaced **(CL Day 6)**	Central Line **Day 7**	Central Line removed **Day 8**	No Central Line
Patient B	Central Line **Day 3**	Central Line **Day 4**	Central Line removed **(CL Day 5)**	No Central Line	Central Line replaced (**CL Day 1)**	CL **Day 2**	CL **Day 3**

Rationale: NHSN surveillance for infection is not aimed at a specific device. Instead surveillance is aimed at identifying risk to the patient that is the result of device use in general.

- In the examples above, Patient A is eligible for a CLABSI beginning on March 31, through April 6, since a CL was in place for some portion of each calendar day until April 6. A BSI with date of event on April 6 would be a CLABSI since the CL had been in place greater than 2 days and was removed the day before the date of event.

- Patient B is eligible for a CLABSI on March 31 (CL Day 3) through April 3. The catheter had been in place > 2 days and an HAI occurring on the day of device discontinuation or the following calendar day is considered a device-associated infection.

Location of attribution: The inpatient location where the patient was assigned on the date of the LCBI event, which is further defined as the date when the first element used to meet the LCBI criterion occurred (see Exception to Location of Attribution below).

Inpatient Dialysis:

Inpatients receiving dialysis are included in any CLABSI surveillance in the location in which they are housed, regardless of whether or not the central line is the only central line and only accessed for dialysis. This also applies to patients in Long-Term Acute Care (LTAC) facilities within Acute Care Facilities when dialysis is received from the Acute Care Facility staff.

Examples: *CLABSIs in the following examples will be attributed to Unit A*

- Patient on Unit A receives onsite dialysis by contracted dialysis staff
- Dialysis staff travels to Unit A to provide dialysis to Unit A patient
- Patient resides on Unit A for inpatient care, but is transported to dialysis unit within the facility for dialysis. Since CLABSIs cannot be attributed to non-bedded locations, such an event must be attributed to the inpatient location housing the patient.

Facilities may choose to capture information about the presence of a dialysis catheter in patients with LCBIs. The BSI collection form includes a data field "Any hemodialysis catheter present," which may be marked yes or no, and utilized internally by facility to identify association of dialysis to LCBI.

Exception to Location of Attribution:

Transfer Rule: If the date of event for a CLABSI is the day of transfer or discharge, or the next day, the infection is attributed to the transferring location. Receiving facilities should share information about such HAIs with the transferring facility to enable reporting. This is called the Transfer Rule and examples are shown below and in Figure 2:

- Patient with a central line in place in the SICU is transferred to the surgical ward. On the next day, the patient meets criterion for an LCBI. This is reported to NHSN as a CLABSI for the SICU.
- Patient without a central line is transferred from the medical ward on hospital day 3 to MICU. Later that day a central line is inserted. The next day, LCBI criteria are met. This would be considered a BSI and attributed to the medical ward; however, it is not a CLABSI because the central line was not in place >2 days on the date of event.
- Patient with a central line in place is transferred from the medical ward to the coronary care ICU (CCU). After four days in the CCU, and with the central line still in place, LCBI criteria are met. This is reported to NHSN as a CLABSI for the CCU.
- After a two-week hospital stay, a patient on the urology ward of Hospital A has his only central line removed and is discharged home a few hours later. The IP from Hospital B calls the next day to report that this patient has been admitted to Hospital B and meets LCBI criteria. This CLABSI should be reported to NHSN for, and by, Hospital A and attributed to the urology ward.

Figure 2: Example of Multiple Transfers within the Transfer Rule Time-Frame

	3/22	3/23	3/24
Locations in which patient was housed	Unit A	Unit A Unit B Unit C	Unit C Unit D This is also the date of event for a CLABSI. CLABSI is attributed to Unit A since Unit A was the first location in which the patient was housed the day before the date of event.

Table 1: Laboratory-Confirmed Bloodstream Infection Criteria

Criterion	**Laboratory-Confirmed Bloodstream Infection (LCBI)** *Comments and reporting instructions that follow the site-specific criteria provide further explanation and are integral to the correct application of the criteria.* Must meet ***one*** of the following criteria:
LCBI 1	Patient has a recognized pathogen cultured from one or more blood cultures **AND** organism cultured from blood is not related to an infection at another site.(See Appendix 1 Secondary BSI Guide)
LCBI 2	Patient has at least one of the following signs or symptoms: fever (>38.0°C), chills, or hypotension **AND** organism cultured from blood is not related to an infection at another site (See Appendix 1 Secondary BSI Guide) **AND** the same common commensal (i.e., diphtheroids [*Corynebacterium* spp. not *C. diphtheriae*], *Bacillus* spp. [not *B. anthracis*], *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci, *Aerococcus* spp., and *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions (see comment 3a below). Criterion elements must occur within the Infection Window Period (see Chapter 2), the seven-day time period which includes the date the positive blood culture was collected, the 3 calendar days before and the 3 calendar days after. (See complete list of common commensals by selecting the common commensal tab at the bottom of the Excel worksheet at http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx) **Note:** The matching common commensals represent a single element; therefore, the collection date of the **first** common commensal is the date of the element used to determine the Date of Event.

6/1/2014	6/2/2014	6/3/2014	6/4/2014	Date of LCBI Event = 6/1/2014
S. epidermidis (1 of 2)	*S. epidermidis* (2 of 2)	No LCBI elements	Fever > 38.0 °C	

LCBI 3	Patient ≤ 1 year of age has at least ***one*** of the following signs or symptoms: fever (>38.0°C), hypothermia (<36.0°C), apnea, or bradycardia **AND** organism cultured from blood is not related to an infection at another site (See Appendix 1 Secondary BSI Guide) **AND** the same common commensal (i.e., diphtheroids [*Corynebacterium* spp. not *C. diphtheriae*], *Bacillus* spp. [not *B. anthracis*], *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci, *Aerococcus* spp., and *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions (see comment 3a below). Criterion elements must occur within the Infection Window Period, the seven-day time period which includes the date the positive blood culture was collected, the 3 calendar days before and the 3 calendar days after. (See complete list of common commensals by selecting the common commensal tab at the bottom of the Excel worksheet at http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx) **Note:** The matching common commensals represent a single element; therefore, the collection date of the ***first*** common commensal is the date of the element used to determine the Date of Event. 6/1/2014: *S. epidermidis* (1 of 2) · 6/2/2014: *S. epidermidis* (2 of 2) · 6/3/2014: No LCBI elements · 6/4/2014: apnea documented · Date of LCBI Event = 6/1/2014

Criterion	**Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI)** *In 2015 when reporting an LCBI, it is required to indicate which of the underlying conditions of the MBI-LCBI criterion was met, if any. All CLABSI, whether LCBI or MBI-LCBI, must be reported if CLABSI is part of your Monthly Reporting Plan.* Must meet ***one*** of the following criteria:
MBI-LCBI 1	Patient of any age meets criterion 1 for LCBI with at least one blood culture growing any of the following intestinal organisms with no other organisms isolated (See Comment #5): *Bacteroides* spp., *Candida* spp., *Clostridium* spp., *Enterococcus* spp., *Fusobacterium* spp., *Peptostreptococcus* spp., *Prevotella* spp., *Veillonella* spp., or Enterobacteriaceae* **And patient meets at least *one* of the following:** 1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture: a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] b. ≥1 liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within 7 calendar days before the date the positive blood culture was collected. 2. Is neutropenic, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after (See Table 4 for example). *See Table 3 for partial list of eligible Enterobacteriaceae genera.

MBI-LCBI 2	Patient of any age meets criterion 2 for LCBI when the blood cultures are growing only viridans group streptococci with no other organisms isolated **And patient meets at least *one* of the following:** 1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture: a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] b. ≥1 liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within 7 calendar days before the date the first positive blood culture was collected. 2. Is neutropenic, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after (See Table 4 for example).
MBI-LCBI 3	Patient ≤1 year of age meets criterion 3 for LCBI when the blood cultures are growing only viridans group streptococci with no other organisms isolated **And patient meets at least *one* of the following:** 1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture: a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] b. ≥20 mL/kg diarrhea in a 24-hour period with onset on or within 7 calendar days before the date the first positive blood culture is collected. 2. Is neutropenic, defined as at least two separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 on or within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after. (See Table 4 for example)
Comments	1. In LCBI criterion 1, the term "recognized pathogen" includes any organism not included on the common commensal list (see criteria 2 and 3 or Supporting Material section at

	http://www.cdc.gov/nhsn/acute-care-hospital/clabsi/index.html for the list of common commensals). 2. LCBI criteria 1 and 2 and MCI-LCBI criteria 1 and 2 may be used for patients of any age, including those patients ≤1 year of age. 3. In LCBI criteria 2 and 3, if the pathogen or common commensal is identified to the species level from one blood culture, and a companion blood culture is identified with only a descriptive name, which is complementary to the companion culture (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 organism along with its antibiogram if available (see Table 2 below). Only genus and species identification should be utilized to determine the sameness of organisms (i.e., matching organisms). No additional comparative methods should be used (e.g., morphology or antibiograms) because laboratory testing capabilities and protocols may vary between facilities. This will reduce reporting variability, solely due to laboratory practice, between facilities reporting LCBIs meeting criterion 2. Report the organism to the genus/species level only once, and if antibiogram data are available, report the results from the most resistant panel. a. In LCBI criteria 2 and 3, the phrase "two or more blood cultures drawn on separate occasions" means, 1) that blood from at least two separate blood draws were collected on the same or consecutive calendar days, and 2) were collected in a manner which suggests that 2 separate blood draw site preparations were performed. This will reduce misidentification of contaminated blood cultures as LCBI. For example, blood cultures drawn from different sites (e.g., different venipunctures, a combination of venipuncture and lumen withdrawal, or different lumens of the same central line) should undergo separate decontaminations and are therefore considered drawn on "separate occasions". b. For pediatric patients, due to volume constraints, a blood culture may consist of a single bottle. Therefore, to meet this part of the criterion, each bottle from two, single bottle blood draws would have to be culture-positive for the same commensal. 4. Specimen Collection Considerations: Although blood cultures drawn through central lines can have a higher rate of contamination than blood cultures collected through peripheral venipuncture [3, 4] all positive blood cultures, regardless of the sites

	from which they were collected, must be included when conducting in-plan CLABSI surveillance. 5. In MBI-LCBI 1, 2 and 3, "No other organisms isolated" means there is not isolation in a blood culture of another recognized pathogen (e.g., *S. aureus*) or common commensal (e.g., coagulase-negative staphylococci) other than listed in MBI-LCBI criterion 1, 2 or 3 that would otherwise meet LCBI criteria. If this occurs, the infection should not be classified as MBI-LCBI.
Reporting Instructions	1. Report organisms cultured from blood as BSI–LCBI when no other site of infection is evident (see Appendix 1. Secondary Bloodstream Infection [BSI] Guide). 2. When another blood culture is collected during the RIT of an identified MBI-LCBI, which is positive for an organism excluded from MBI-LCBI criteria, the MBI-LCBI event is edited to become an LCBI and the organism is added. 3. Catheter tip cultures are not used to determine whether a patient has a primary BSI. 4. 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. 5. Purulent phlebitis confirmed with a positive semiquantitative culture of a catheter tip, **but with either negative or no blood culture** is considered a CVS-VASC, not a BSI, SST-SKIN, or a ST infection. 6. 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 (i.e., pus at the insertion site and/or matching pathogen from pus and blood). In this situation, enter "Central Line = No" in the NHSN application. You should, however, include the patient's central line days in the summary denominator count. 7. If your state or facility requires that you report healthcare-associated BSIs that are not central line-associated, enter "Central Line = No" in the NHSN application when reporting these BSIs. You should, however, include all of the patient's central line days in the summary denominator count.

Table 2: Examples of How to Report Speciated and Unspeciated Organisms Isolated from Blood Cultures

Culture Report	**Companion Culture Report**	**Report as…**
Coagulase-positive staphylococci	*S. aureus*	*S. aureus*
S. epidermidis	Coagulase-negative staphylococci	*S. epidermidis*
Enterococcus spp.	*E. faecium*	*E. faecium*
Bacillus spp. (not *anthracis*)	*B. cereus*	*B. cereus*
S. salivarius	Strep viridans	*S. salivarius*

Table 3: Partial List of Criterion 1 MBI-LCBI Eligible Enterobacteriaceae Genera

Citrobacter
Enterobacter
Escherichia
Klebsiella
Proteus
Providencia
Salmonella
Serratia
Shigella
Yersina

Note: See complete list of MBI Pathogens by selecting the MBI Organisms tab at the bottom of the Excel worksheet at http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx

Table 4: Examples Illustrating the MBI-LCBI Criteria for Neutropenia

		Day -7	Day -6	Day -5	Day -4	Day -3	Day -2	Day -1	Day 1*	Day 2	Day 3	Day 4
Pt. A	**WBC**	**100**	**800**	**400**	**300**	**ND**	**ND**	**320**	**400 + BC* w/ *Candida* spp. x1**	**ND**	**550**	**600**
Pt. B	**ANC**	**ND**	**410**	**130**	**ND**	**ND**	**120**	**110**	**ND +BC* w/ viridans strep x2 and fever >38°C**	**110**	**300**	**320**
Pt. C	**WBC**	**100**	**800**	**400**	**300**	**ND**	**ND**	**ND**	**600 + BC* w/ *Candida* spp. x1**	**230**	**ND**	**400**

*ND = not done; *Day the blood specimen that was positive was collected*

Patient A meets MBI-LCBI criterion 1, sub-criterion 2: Positive blood culture with intestinal organism (*Candida* spp.) and neutropenia (2 separate days of WBC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, the Day 1 value = 400, and Day -1 value = 320.

Patient B meets MBI-LCBI criterion 2, sub-criterion 2: At least two positive blood cultures with viridans group streptococci (in this case, two positive), and fever >38°C and neutropenia (two separate days of ANC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, the Day -1 value = 110 and Day -2 value = 120.

Note: any two of Days -2,-1, 2, 3, and 4 could be used to meet this requirement since WBC or ANC under 500 were present on those days.

Patient C meets MBI-LCBI criterion 1, sub-criterion 2: Positive blood culture with intestinal organism (*Candida* spp.) and neutropenia (2 separate days of WBC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, Day 2 value =230 and Day 4value = 400]).

Numerator Data: The *Primary Bloodstream Infection (BSI)* form (CDC 57.108) is used to collect and report each CLABSI that is identified during the month selected for surveillance. The Instructions for Completion of Primary Bloodstream Infection (BSI) form contains brief instructions for collection and entry of each data element on the form. The *Primary BSI* form includes patient demographic information and whether a central line was present, and, if so, the type of central line the patient had if appropriate to the location; these data will be used to calculate line-specific infection rates. Additional data include the specific criteria met for identifying the primary BSI, whether the patient died, the organisms isolated from blood cultures, and the organisms' antimicrobial susceptibilities.

Reporting Instruction:
If no CLABSIs are identified during the month of surveillance, the "Report No Events" box must be checked on the appropriate denominator summary screen, e.g., Denominators for Intensive Care Unit (ICU)/other locations (Not NICU or SCA), etc.

Denominator Data: Device days and patient days are used for denominators. Device-day denominator data that are collected differ according to the location of the patients being monitored. The following methods can be used for the collection of denominator data:

Denominator Data Collection Method	**Details**
Manual, Daily (i.e., collected at the same time every day of the month)	Denominator data are collected at the same time, every day, per location. For locations other than specialty care areas/oncology (SCA/ONC) and NICUs, the number of patients with one or more central lines of any type is collected daily, at the same time each day, during the month and recorded on the *Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or SCA/ONC)* form (CDC 57.118). Only the totals for the month are entered into NHSN. For specialty care areas/oncology, the number of patients with one or more central lines is dichotomized into those with permanent central lines and those with temporary central lines on the *Denominators for Specialty Care Area (SCA)/Oncology (ONC)* form (CDC 57.117). Each is collected daily, at the same time each day. Only the totals for the month are entered into NHSN. This distinction in lines is made because permanent lines are commonly used in patients frequenting these areas and may be associated with lower rates of BSI than central lines inserted for temporary use. If a

Denominator Data Collection Method	Details
	patient has both a temporary and a permanent central line, count the day only as a temporary line day. The Instructions for Completion of Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU and SCA/ONC) and Instructions for Completion of Denominators for Specialty Care Areas (SCA)/Oncology (ONC) contain brief instructions for collection and entry of each data element on the forms. In NICUs, the number of patients with one or more central lines is stratified by birth weight in five categories since risk of BSI varies by birth weight. These data are collected on the *Denominators for Neonatal Intensive Care Unit (NICU)* form (CDC 57.116). **Note:** The weight of the infant at the time of BSI is not used and should not be reported. For example, if a neonate weighs 1006 grams at birth but remains in the NICU for two months and has a body weight of 1650 grams when a CLABSI develops, record the birth weight of 1006 grams on the BSI form. The Instructions for Completion of Denominators for Neonatal Intensive Care Unit (NICU) form contains brief instructions for collection and entry of each data element on the forms.
Manual, sampled once/week (i.e., collected at the same time on the same designated day, once per week)	For locations other than specialty care areas/oncology (SCA/ONC) and NICUs (e.g., ICUs, step-down units, wards), the denominator sampling method can be used. To reduce staff time spent collecting surveillance data, once weekly sampling of denominator data to generate estimated central line days, may be used as an alternative to daily collection in non-oncology ICUs and wards. The number of patients in the location (patient-days) and the number of patients with one or more central lines of any type (central line days) is collected on a designated day each week (e.g., every Tuesday), at the same time during the month. Evaluations of this method have repeatedly shown that use of Saturday or Sunday generate the least accurate estimates of denominator data, therefore, these days should not be selected as the designated day.[6-8] If the day designated for the collection of sampled data is missed, collect the data on the next available day instead.

Denominator Data Collection Method	Details
	The following must be collected and entered into NHSN: 1. The monthly total for patient-days, based on collection daily 2. The sampled total for patient-days 3. The sampled total central line-days When these data are entered, the NHSN application will calculate an estimate of central line-days. **Notes:** • To ensure the accuracy of estimated denominator data obtained by sampling, only ICU and ward location types with an average of 75 or more central line-days per month are eligible to use this method. A review of each location's central line denominator data for the past twelve months in NHSN will help determine which locations are eligible. • The accuracy of estimated denominator data generated by sampling can be heavily influenced by incorrect or missing data. Careful implementation of data collection following the guidance in this protocol is essential to avoid erroneous fluctuations in rates or SIRs.
Electronic	For <u>any</u> location, when denominator data are available from electronic sources (e.g., central line days from electronic charting), these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected, once a day counts, pre-validated for a minimum of three months. The validation of electronic counts should be performed for each location separately.

Data Analyses: The Standardized Infection Ratio (SIR) [9] is calculated by dividing the number of observed infections by the number of predicted infections. The number of predicted infections is calculated using CLABSI rates from a standard population during a baseline time period, which represents a standard population's CLABSI experience.[10, 11]
Note: The SIR will be calculated only if the number of predicted CLABSIs (numExp) is ≥1 to help enforce a minimum precision criterion.

Note: In the NHSN application, "predicted" is referred to as "expected".

$$SIR = \frac{\text{Observed (O) HAIs}}{\text{Expected (E) HAIs}}$$

While the CLABSI SIR can be calculated for single locations, the measure also allows you to summarize your data across multiple locations, adjusting for differences in the incidence of infection among the location types. For example, you can obtain one CLABSI SIR adjusting for all locations reported. Similarly, you can obtain one CLABSI SIR for all ICUs in your facility.

Note: Only those locations for which baseline data have been published will be included in the SIR calculations. For acute care hospitals, the baseline time period is 2006-2008; for long term acute care hospitals, the baseline time period is 2013.[10,11]

The CLABSI rate per 1000 central line days is calculated by dividing the number of CLABSIs by the number of central line days and multiplying the result by 1000. The Central Line Utilization Ratio is calculated by dividing the number of central line days by the number of patient days. These calculations will be performed separately for different types of ICUs, specialty care areas, oncology units, and other locations in the institution. Separate rates and ratios will also be calculated for different types of catheters in specialty care areas/oncology locations and for birth weight categories in NICUs.

Descriptive analysis output options of numerator and denominator data, such as line listings, frequency tables, and bar and pie charts are available in the NHSN application. CLABSI SIRs, rates, and run charts are also available. Guides on using NHSN analysis features are available from: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

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Appendix1: Secondary Bloodstream Infection (BSI) Guide (*not applicable to Ventilator-associated Events [VAE]*)

What is the meaning of the statement "not related to infection at another site" in relation to a positive blood culture?

The purpose of using the CDC/NHSN infection criteria is to identify and consistently categorize infections that are healthcare-associated into major and specific infection sites or types. LCBI criteria include the caveat that the organism(s) cultured from the blood cannot be related to infection at another site (i.e., must be a primary BSI). One must be sure that there is no other CDC-defined primary site of infection that may have seeded the bloodstream secondarily; otherwise the bloodstream infection may be misclassified as a primary BSI and erroneously associated with the use of a central line, i.e., called a CLABSI. For locations performing in-plan VAE surveillance, refer to Figure 4 in this appendix, as well as the VAE chapter for specific guidance on assigning a secondary BSI to a VAE.

For purposes of NHSN, in order for a bloodstream infection to be determined to be secondary to a primary infection site, (i.e. related to an infection at another site, such that the primary site of infection may have seeded the bloodstream secondarily), the patient must meet all three‡ below:

1. **Meet one of the NHSN site specific definitions (CDC/NHSN Surveillance Definitions for Specific Types of Infections),**
2. **Have a positive blood culture within the Secondary BSI Attribution Period (See Chapter 2),**
   AND
3. **Meet requirements in Secondary BSI Scenario 1 or 2 below.**

‡**Exception:**
Since necrotizing enterocolitis (NEC) criteria include neither a site specific culture nor a positive blood culture, an exception for assigning a BSI secondary to NEC is provided. A BSI is considered secondary to NEC if the patient meets one of the two NEC criteria **AND** a positive blood culture(s) collected during the secondary BSI attribution period is positive for an LCBI pathogen or the same common commensal is cultured from two or more blood cultures drawn on separate occasions collected on the same or consecutive days.

Secondary BSI Scenarios

Below are two potential scenarios with guidance on how to distinguish between the primary or secondary nature of a BSI. The definition of "matching organisms", and important notes and reporting instructions are also provided.

See Figure 3: Secondary BSI Guide for algorithmic display of the following instructions.

Scenario 1: Blood and site-specific specimen cultures match for at least one organism: In a patient suspected of having an infection, if blood and a site-specific specimen are collected for culture and both are positive for at least one matching organism, AND if the site-specific culture is an element used to meet the infection site criterion, the BSI is considered secondary to that site-specific infection.

a. **Example:** Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture collected during the secondary BSI attribution period is positive for *E. coli*. This is an HAI SUTI with a secondary BSI and the reported organism is *E. coli*.
b. **Example:** Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture collected during the SUTI secondary BSI attribution period grows *E. coli* and *P. aeruginosa*. This is an HAI SUTI with a secondary BSI and the reported organisms are *E. coli* and *P. aeruginosa*, since both site and blood culture are positive for at least one matching pathogen.
c. **Example:** Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture collected during the SUTI secondary BSI attribution period *E. coli* and *S. epidermidis*. This is an HAI SUTI with a secondary BSI and the reported organism is only *E. coli*, since the single common commensal *S. epidermidis* positive blood culture by itself does not meet BSI criteria.

Scenario 2: Blood and site-specific specimen cultures do <u>not</u> match: There are two scenarios that can occur when a patient suspected of having an infection has blood and a site-specific specimen cultured but the organisms do not match.

a. If the blood isolate is an element used to meet the site-specific criterion, then the BSI is considered secondary to that site-specific infection.

    i. **Example:** Postoperative patient becomes febrile and complains of nausea and abdominal pain. Blood and an aseptically-obtained T-tube drainage specimen are collected for culture. A CT scan done that day shows fluid collection suggestive of infection. Culture results show *Escherichia coli* from the T-tube drainage specimen but the blood grows *Bacteroides fragilis*. Because the patient meets IAB criteria during the infection window period, by positive site-

specific culture (IAB criterion 3a) and by positive blood culture as an element of a different criterion of the same infection site (IAB 3b), the blood is considered a secondary BSI to an IAB and both organisms would be listed as the IAB infection pathogens. No primary BSI would be reported.

ii. **Example:** Patient is febrile, has a new onset of cough and has positive chest radiographs indicating the presence of an infiltrate. Blood and bronchoalveolar lavage (BAL) cultures are collected. Culture results show *Klebsiella pneumonia* > 10^4 cfu/ml from the BAL and *Pseudomonas aeruginosa* from the blood. Because the patient can meet PNU2 definition by using the positive blood culture as one of the elements of the infection criterion (i.e. infiltrate on chest x-rays, fever, new onset of cough and positive blood culture), the blood is considered a secondary BSI to a PNEU. No primary BSI would be reported.

b. If the site-specific culture is an element used to meet the infection site criterion and the blood isolate is not, then the BSI is considered a primary infection.

iii. **Example:** Postoperative patient has an intraabdominal abscess (IAB) noted during reoperation and purulent material is obtained at that time which grows Escherichia coli. The patient spikes a fever two days later and blood culture shows *Bacteroides fragilis*. Because the organisms from the site and blood cultures do not match, and no site-specific criterion that includes positive blood culture as an element is met, both a site-specific infection (GI-IAB criteria 1 and 2) and a primary BSI would be reported.

iv. **Example:** Unconscious ICU patient with a Foley catheter and central line for past four days spikes a fever; blood, urine and sputum specimens are collected for culture. The urine culture grows >100,000 CFU/ml of *Escherichia coli*, blood culture grows Enterococcus faecium, and sputum shows oral flora only. Because the organisms from the urine and blood cultures do not match, and a UTI criterion that includes positive blood culture as an element is not met, both a SUTI (SUTI criterion 1a) and a primary BSI would be reported. This infection does not meet the ABUTI criterion since that requires at least one matching organism in urine and blood in an asymptomatic patient.

A **matching organism** is defined as one of the following:

1. If genus and species are identified in both cultures, they must be the same.
    a. **Example:** A blood culture reported as *Enterobacter cloacae* and an intraabdominal specimen of *Enterobacter cloacae* are matching organisms.
    b. **Example:** A blood culture reported as *Enterobacter cloacae* and an intraabdominal specimen of *Enterobacter aerogenes* are NOT matching organisms as the species are different.

2. If the organism is less definitively identified in one culture than the other, the identifications must be complementary.
    a. **Example:** A surgical wound growing *Pseudomonas* spp. and a blood culture growing *Pseudomonas aeruginosa* are considered a match at the genus level and therefore the BSI is reported as secondary to the SSI.
    b. **Example:** A blood culture reported as *Candida albicans* and a culture from a decubitus reported as yeast are considered to have matching organisms because the organisms are complementary, i.e. Candida is a type of yeast.

Notes:

- Antibiograms of the blood and potential primary site isolates do not have to match.
- If the blood isolate by itself does not meet BSI criteria (e.g., only one positive blood culture of a common commensal), then that isolate may not be used to indicate the presence of a secondary BSI (see scenario1c).

Reporting Instructions:

- For reporting secondary BSI for possible PVAP, see Figure 4 and Chapter 10.
- Do not report secondary bloodstream infection for vascular (VASC) infections, Ventilator-Associated Conditions (VAC), or Infection-related Ventilator-Associated Complications (IVAC), pneumonia 1 (PNEU 1).

Pathogen Assignment

Pathogens cultured from secondary BSIs, should be added to those pathogens reported for the primary infection type. The Secondary BSI data collection field should be checked yes.

A secondary BSI pathogen may be assigned to two different primary site infections (e.g., UTI and an IAB infection). Two primary site infections have been identified and a blood culture is collected within both the SUTI and the IAB secondary BSI attribution period. The blood culture pathogen matches both primary site infection pathogens. Therefore the pathogen is reported for both primary sites as a secondary bloodstream infection.

Example 1: Pathogen Assignment

Hospital Day	BSI	RIT	Infection Window Period	Infection Window Period		BSI
1						
2						
3						
4		1	**Urine culture**: >100,000 cfu/ml *K. pneumoniae*			
5		2	Fever > 38.0 C			
6		3				
7		4				
8		5		Fever >38.0 C, Abdominal pain		
9		6		CT Scan : Abdominal abscess		
10		7	Blood culture: *K. pneumoniae*	Blood culture: *K. pneumoniae*		
11		8				
12		9				
13		10				
14		11				
15		12				
16		13				
17		14				
18						
19						
20						
21						
22						
23						
			SUTI & Secondary BSI Date of Event = 4 Pathogen: *K. pneumoniae*	**IAB & Secondary BSI Date of Event = 8 Pathogen: *K. pneumoniae***		

Infection Window Period
(First positive diagnostic test, 3 days before and 3 days after)

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (Infection Window Period + RIT)

Date of Event (DOE)
(Date the first element occurs for the first time within the infection window period)

Pathogens excluded from specific infection definitions (e.g., yeast in UTI, or Enterococcus spp. for PNEU) are also excluded as pathogens for BSIs secondary to that type of infection (i.e., they cannot be added on to one of these infections as a pathogen). The excluded organism must be accounted for as either 1) a primary bloodstream infection (BSI/CLABSI) or, 2) a secondary bloodstream infection attributed to another primary infection (e.g., IAB, SINU). A blood culture with yeast and *E. faecalis* is collected during the SUTI RIT. A BSI secondary to SUTI is identified. *E. faecalis* is already documented as a pathogen, but the yeast will not be reported as a secondary BSI pathogen, because yeasts are excluded as organisms in the UTI definition. Because no other primary source of infection for which the yeast BSI can be assigned as secondary is found, a primary BSI with yeast is identified.

Example 2: Pathogen Assignment (continued)

Hospital Day	BSI	RIT	Infection Window Period	Infection Window Period	RIT
1					
2					
3		1	Dysuria		
4		2	**Urine culture**: > 100,000 cfu/ml *E. faecalis*		
5		3			
6		4			
7		5			
8		6			
9		7			
10		8			
11		9	Blood culture: *E.faecalis* / Yeast	**Blood culture:** *E. faecalis* / Yeast	1
12		10			2
13		11			3
14		12			4
15		13			5
16		14			6
17					7
18					8
19					9
20					10
21					11
22					12
23					13
24					14
25					
			UTI & Secondary BSI Date of Event = 3 Pathogen: *E. faecalis*	**Primary BSI Date of Event = 11 Pathogen: Yeast**	

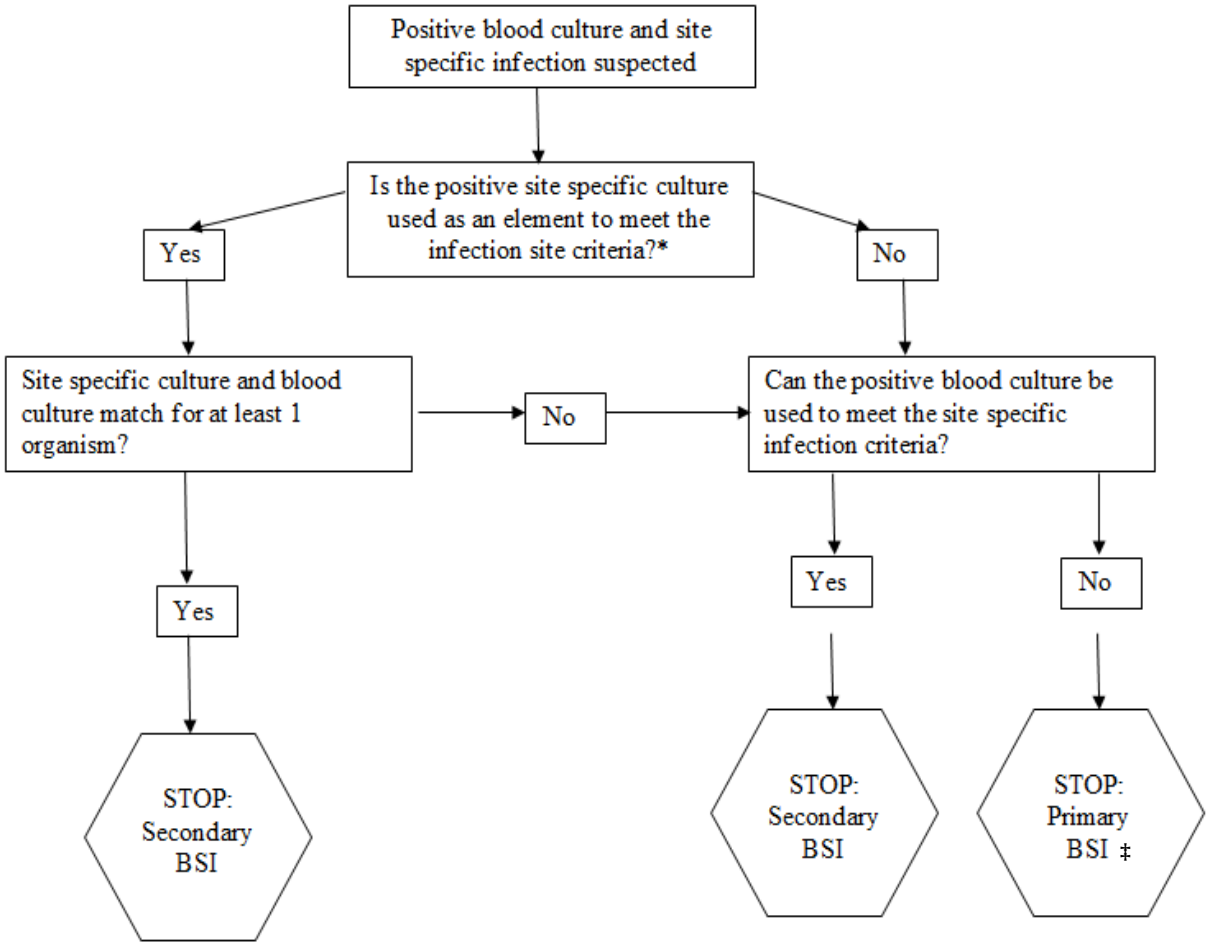
Infection Window Period
(First positive diagnostic test, 3 days before and 3 days after)

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period
(Infection Window Period + RIT)

Date of Event (DOE)
(Date the first element occurs for the first time within the infection window period)

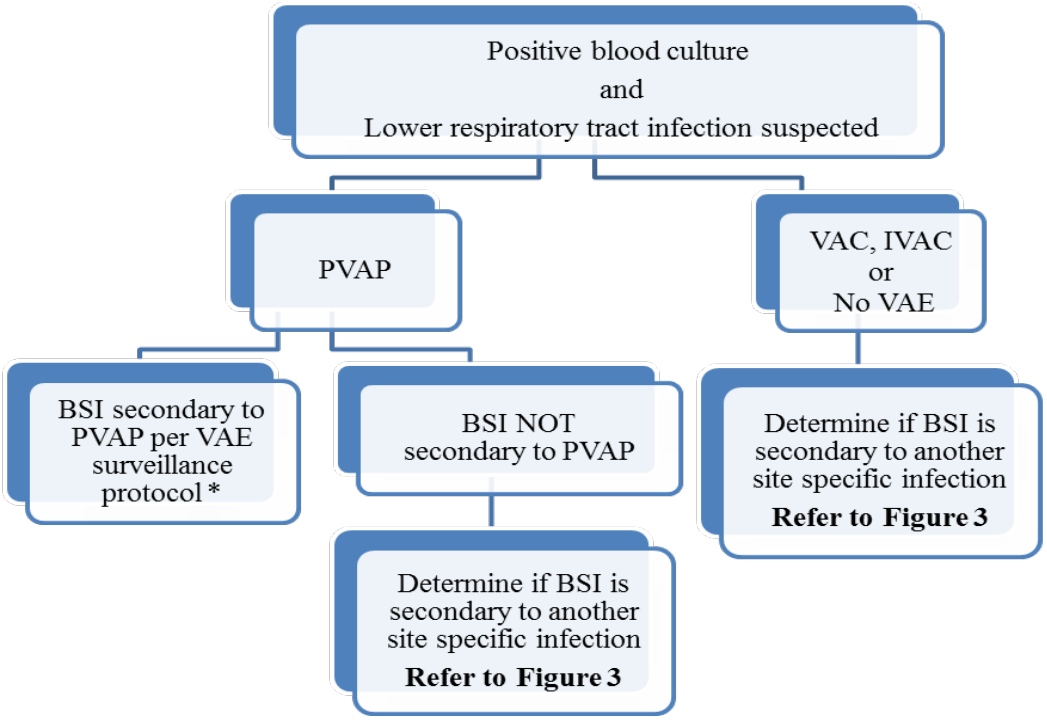
Figure 3: Secondary BSI Guide for eligible organisms*‡
(Not applicable to Ventilator-associated Events [VAE], See Figure 4)



*If an organism is excluded as a causative agent for a site specific infection (i.e. yeast in UTI), the blood cannot be considered secondary to that site.

‡**Exception:** Since necrotizing enterocolitis (NEC) criteria include neither a site specific culture nor a positive blood culture, an exception for assigning a BSI secondary to NEC is provided. A BSI is considered secondary to NEC if the patient meets one of the 2 NEC criteria AND a positive blood culture(s) collected during the secondary BSI attribution period is positive for an LCBI pathogen or the same common commensal is cultured from 2 or more blood cultures drawn on separate occasions collected on the same or consecutive days.

Figure 4: VAE Guidance for Secondary BSI Determination



*Secondary BSIs may be reported for possible VAP (PVAP) events, provided that at least one organism isolated from the blood culture matches an organism isolated from an appropriate respiratory tract specimen (including respiratory secretions, pleural fluid and lung tissue). The respiratory tract specimen must have been collected on or after the 3rd day of mechanical ventilation and within 2 calendar days before or after the day of onset of worsening oxygenation to be considered as a criterion for meeting the PVAP definitions. In addition, the positive blood culture must have been collected during the 14-day event period, where day 1 is the day of onset of worsening oxygenation.

- In cases where PVAP is met with only the histopathology criterion and no culture is performed, and there is also a positive blood culture, a secondary BSI to VAE is not reported.
- In cases where a culture of respiratory secretions, pleural fluid or lung tissue is performed and does not grow an organism that matches an organism isolated from blood, a secondary BSI to VAE is not reported.

Note: Candida species or yeast not otherwise specified, coagulase-negative Staphylococcus species, and Enterococcus species cultured from blood cannot be deemed secondary to a PVAP, unless the organism was also cultured from pleural fluid or lung tissue.

Pneumonia (Ventilator-associated [VAP] and non-ventilator-associated Pneumonia [PNEU]) Event

Introduction: In 2011, an estimated 157,000 healthcare-associated pneumonias occurred in acute care hospitals in U.S.[1] Patients with mechanically-assisted ventilation have a high risk of developing healthcare-associated pneumonia. In 2012, the overall ventilator use in various hospital unit types ranged from 0.01 to 0.47 per 100 patient days and the pooled incidence of VAP in in these units ranged from 0.0 to 4.4 per 1,000 ventilator days.[2]
Prevention and control of healthcare-associated pneumonia is discussed in the CDC/HICPAC document, *Guidelines for Prevention of Healthcare-Associated Pneumonia, 2003*[3]. The Guideline strongly recommends that surveillance be conducted for bacterial pneumonia in ICU patients who are mechanically ventilated to facilitate identification of trends and for inter-hospital comparisons.

Settings: Surveillance may occur in any inpatient pediatric location where denominator data can be collected, such as critical/intensive care units (pedICUs), specialty care areas (SCA), step-down units, wards, and long term care units. In 2015, in-plan surveillance for ventilator-associated pneumonia (pedVAP) using the criteria found in this chapter will be restricted to patients of any age in pediatric locations (excludes neonatal locations). In 2015 in-plan surveillance conducted for mechanically-ventilated patients in adult locations (regardless of age) will use the Ventilator-Associated Event (VAE) protocol (see VAE chapter). The PNEU definitions are still available for those units seeking to conduct off-plan PNEU surveillance for mechanically-ventilated adult, pediatric and neonatal patients and non-ventilated adults, pediatric or neonatal patients. A complete listing of inpatient locations and instructions for mapping can be found in the CDC Locations and Descriptions chapter.

Note: If you are following pedVAP in your monthly reporting plan it is not required to monitor for VAPs after the patient is discharged from the facility. However, if discovered, any VAPs with event date on the day of discharge or day after discharge should be reported to NHSN. (See Transfer Rule below). No additional ventilator days are reported.

Definitions:

Present on Admission (POA): Infections that are POA, as defined in Chapter 2, are not considered HAIs and therefore are never reported to NHSN. **Note:** POA reporting exception for PNEU/VAP: One chest radiograph is acceptable to meet POA criteria for PNEU/VAP protocol, regardless of whether the patient has underlying pulmonary or cardiac disease.

Healthcare-associated infections (HAI): All NHSN site specific infections must first meet the HAI definition as defined in Chapter 2 before a site specific infection (e.g.,PNEU/VAP) can be reported to NHSN.

Note: For patients with underlying pulmonary or cardiac disease who are required to have serial imaging test results, to satisfy the PNEU/VAP definitions, the second imaging test must occur within seven days of the first but is not required to occur within the Infection Window Period. The date of the first CXR will be utilized when determining if the PNEU/VAP criteria are met within the infection window period. All other elements of PNEU/VAP definition must be present within the infection window period.

Pneumonia (PNEU) is identified by using a combination of imaging, clinical and laboratory criteria. The following pages detail the various criteria that may be used for meeting the surveillance definition of healthcare-associated pneumonia (Tables 1-4 and Figures 1 and 2), general comments applicable to all site - specific criteria, and reporting instructions. Table 5 shows threshold values for cultured specimens used in the surveillance diagnosis of pneumonia.

Date of event: For a PNEU/VAP the date of event is the date when the first element used to meet the PNEU infection criterion occurred for the first time within the 7-day Infection Window Period.

Ventilator: A device to assist or control respiration inclusive of the weaning period, through a tracheostomy or by endotracheal intubation.

Note: Lung expansion devices such as intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP).

Ventilator-associated pneumonia (VAP): A pneumonia where the patient is on mechanical ventilation for >2 calendar days on the date of event, with day of ventilator placement being Day 1,

AND

the ventilator was in place on the date of event or the day before. If the patient is admitted or transferred into a facility on a ventilator, the day of admission is considered Day1.

Location of attribution: The inpatient location where the patient was assigned on the date of the PNEU/VAP event (see Date of Event). See Exception of Location Attribution below.

Exception to Location of Attribution:

Transfer Rule: If the date of event for a PNEU/VAP is on the date of transfer or the next day, the infection is attributed to the transferring/discharging location. If the patient was in multiple locations within the transfer rule time frame, attribute the infection to the original location initiating the transfer. This is called the Transfer Rule and examples are shown below:

- Child has been on a ventilator for 7 days in the PICU and is transferred on the ventilator to the pediatric surgical ward. The criteria for PNEU are met and the date of event is the day following the transfer. This is reported to NHSN as a VAP for the PICU.
- Child has been on a ventilator for 5 days and is transferred in the morning to the pediatric medical ward from the pediatric medical critical care unit after having ventilator discontinued. The criteria for a PNEU are met and the date of event is the day of transfer. This is reported to NHSN as a VAP for the pediatric medical critical care unit.
- Pediatric patient on a ventilator is transferred from the neonatal intensive care unit (NICU) to the pediatric intensive care unit (PICU). The patient meets the criteria for a PNEU and the date of event is 4 days post transfer. This is reported to NHSN as a VAP for the PICU.

General Comments Applicable to All Pneumonia Specific Site Criteria:

- Physician's diagnosis of pneumonia alone is not an acceptable criterion for POA (present on admission) or HAI (healthcare-associated) pneumonia.
- Although specific criteria are included for infants and children and immunocompromised patients, all patients may meet any of the other pneumonia specific site criteria.
- Pneumonia due to gross aspiration (for example, in the setting of intubation in the field, emergency department, or operating room) that meets the PNEU/VAP definition with a date of event during the HAI timeframe is considered healthcare-associated (HAI).
- Multiple episodes of healthcare-associated pneumonia may occur in critically ill patients with lengthy hospital stays. When determining whether to report multiple episodes of healthcare-associated pneumonia in a single patient, follow the Repeat Infection Timeframe (RIT) guidance found in Chapter 2.
- Excluded organisms and culture results that cannot be used to meet the PNEU/VAP definition are as follows:
    1. "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract
    2. The following organisms unless isolated from cultures of lung tissue or pleural fluid
        i. *Candida* species* or yeast not otherwise specified
        ii. coagulase-negative *Staphylococcus* species
        iii. *Enterococcus* species

    **Candida* species isolated from sputum or endotracheal aspirate specimen combined with a matching blood culture can be used to satisfy the PNU3 definition.

3. Additionally, because organisms belonging to the following genera are typically causes of community-associated respiratory infections and are rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet the PNEU/VAP definition when isolated from any eligible specimen type (to include lung and pleural fluid): *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.*

- Abbreviations used in the PNEU laboratory criteria:

  BAL–bronchoalveolar lavage
  EIA–enzyme immunoassay
  FAMA–fluorescent-antibody staining of membrane antigen
  IFA–immunofluorescent antibody
  LRT–lower respiratory tract
  PCR–polymerase chain reaction
  PMN–polymorphonuclear leukocyte
  RIA–radioimmunoassay

Reporting Instructions:

- There is a hierarchy of specific categories within the major site pneumonia. If the patient meets criteria for more than one specific site during the infection window period or the RIT, report only one:
  - If a patient meets criteria for both PNU1 and PNU2, report PNU2.
  - If a patient meets criteria for both PNU2 and PNU3, report PNU3.
  - If a patient meets criteria for both PNU1 and PNU3, report PNU3.
- Secondary bloodstream infections can only be reported for PNU2 and PNU3 specific events.
- Report concurrent LUNG (e.g., abscess or empyema) and PNEU with at least one matching organism(s) as PNEU.
- Lung abscess or empyema without pneumonia is classified as LUNG

Table 1: Specific Site Algorithms for Clinically Defined Pneumonia (PNU1)

Imaging Test Evidence	**Signs/Symptoms/Laboratory**
Two or more serial chest imaging test results with at least ***one*** of the following[1,2]: • New or progressive and persistent infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old **Note:** In patients ***without*** underlying pulmonary or cardiac disease (e.g., respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive imaging test result is acceptable.[1]	For ANY PATIENT, at least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • Leukopenia (<4000 WBC/mm^3) or leukocytosis (≥12,000 WBC/mm^3) • For adults ≥70 years old, altered mental status with no other recognized cause And at least ***two*** of the following: • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough, or dyspnea, or tachypnea[5] • Rales[6] or bronchial breath sounds • Worsening gas exchange (e.g., O_2 desaturations (e.g., PaO_2/FiO_2 ≤240)[7], increased oxygen requirements, or increased ventilator demand)
	ALTERNATE CRITERIA, for infants ≤1 year old: Worsening gas exchange (e.g., O_2 desaturations [e.g. pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand) And at least ***three*** of the following: • Temperature instability • Leukopenia (<4000 WBC/mm^3) or leukocytosis (≥15,000 WBC/mm^3) and left shift (≥10% band forms) • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions or increased suctioning requirements • Apnea, tachypnea[5], nasal flaring with retraction of chest wall or nasal flaring with grunting • Wheezing, rales[6], or rhonchi • Cough • Bradycardia (<100 beats/min) or tachycardia (>170 beats/min)
	ALTERNATE CRITERIA, for child >1 year old or ≤12 years old, at least ***three*** of the following: • Fever (>38. 0°C or >100. 4°F) or hypothermia (<36. 0°C or <96. 8°F) • Leukopenia (<4000 WBC/mm^3) or leukocytosis (≥15,000 WBC/mm^3) • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough, or dyspnea, apnea, or tachypnea[5]. • Rales[6] or bronchial breath sounds • Worsening gas exchange (e.g., O_2 desaturations [e.g., pulse oximetry <94%], increased oxygen requirements, or increased ventilator demand)

Table 2: Specific Site Algorithms for Pneumonia with Common Bacterial or Filamentous Fungal Pathogens and Specific Laboratory Findings (PNU2)

Imaging Test Evidence	**Signs/Symptoms**	**Laboratory**
Two or more serial chest imaging test results with at least ***one*** of the following[1,2]: • New or progressive and persistent infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old **Note**: In patients ***without*** underlying pulmonary or cardiac disease (e.g., respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.[1]	At least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • Leukopenia (<4000 WBC/mm^3) or leukocytosis (≥12,000 WBC/mm^3) • For adults ≥70 years old, altered mental status with no other recognized cause And at least ***one*** of the following: • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough, or dyspnea or tachypnea[5] • Rales[6] or bronchial breath sounds • Worsening gas exchange (e.g., O_2 desaturations [e.g., PaO_2/FiO_2 ≤240][7], increased oxygen requirements, or increased ventilator demand)	At least ***one*** of the following: • Positive growth in blood culture[8] not related to another source of infection • Positive growth in culture of pleural fluid[9] • Positive quantitative culture[9] from minimally-contaminated LRT specimen (e.g., BAL or protected specimen brushing) • ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (e.g., Gram's stain) • Positive quantitative culture[9] of lung tissue • Histopathologic exam shows at least ***one*** of the following evidences of pneumonia: o Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli o Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae

Table 3: Specific Site Algorithms for Viral, Legionella, and other Bacterial Pneumonias with Definitive Laboratory Findings (PNU2)

Imaging Test Evidence	**Signs/Symptoms**	**Laboratory**
Two or more serial chest imaging test results with at least ***one*** of the following[1,2]: • New or progressive and persistent infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old **Note:** In patients ***without*** underlying pulmonary or cardiac disease (e.g., respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.[1]	At least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • Leukopenia (<4000 WBC/mm^3) or leukocytosis (≥12,000 WBC/mm^3) • For adults ≥70 years old, altered mental status with no other recognized cause And at least ***one*** of the following: • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough or dyspnea, or tachypnea[5] • Rales[6] or bronchial breath sounds • Worsening gas exchange (e.g., O_2 desaturations [e.g., PaO_2/FiO_2 ≤240][7], increased oxygen requirements, or increased ventilator demand)	At least ***one*** of the following: • Positive culture of virus, *Legionella* or *Chlamydia* from respiratory secretions • Positive non culture diagnostic laboratory test of respiratory secretions or tissue for virus, *Bordetella*, *Chlamydia*, *Mycoplasma*, *Legionella* (e.g., EIA, FAMA, shell vial assay, PCR, micro-IF) • Fourfold rise in paired sera (IgG) for pathogen (e.g., influenza viruses, *Chlamydia*) • Fourfold rise in *L. pneumophila* serogroup 1 antibody titer to ≥1:128 in paired acute and convalescent sera by indirect IFA. • Detection of *Legionella pneumophila* serogroup 1 antigens in urine by RIA or EIA

Table 4: Specific Site Algorithm for Pneumonia in Immunocompromised Patients (PNU3)

Imaging Test Evidence	**Signs/Symptoms**	**Laboratory**
Two or more serial chest imaging test results with at least ***one*** of the following[1,2]: • New or progressive and persistent infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old **Note:** In patients ***without*** underlying pulmonary or cardiac disease (e.g., respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.[1]	Patient who is immunocompromised (see definition in footnote [10] has at least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • For adults ≥70 years old, altered mental status with no other recognized cause • New onset of purulent sputum[3], or change in character ofsputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough, or dyspnea, or tachypnea[5] • Rales[6] or bronchial breath sounds • Worsening gas exchange (e.g., O_2 desaturations [e.g., PaO_2/FiO_2 ≤240][7], increased oxygen requirements, or increased ventilator demand) • Hemoptysis • Pleuritic chest pain	At least ***one*** of the following: • Matching positive blood and sputum or endotracheal aspirate cultures with *Candida* spp.[11,12] • Evidence of fungi from minimally-contaminated LRT specimen (e.g., BAL or protected specimen brushing) from one of the following: – Direct microscopic exam – Positive culture of fungi – Non-culture diagnostic laboratory test Any of the following from: **LABORATORY CRITERIA DEFINED UNDER PNU2**

Footnotes to Algorithms and Flow Diagram:

1. Occasionally, in non-ventilated patients, the diagnosis of healthcare-associated pneumonia may be quite clear on the basis of symptoms, signs, and a single definitive chest imaging test result. However, in patients with pulmonary or cardiac disease (e.g., interstitial lung disease or congestive heart failure), the diagnosis of pneumonia may be particularly difficult. Other non-infectious conditions (e.g., pulmonary edema from decompensated congestive heart failure) may simulate the presentation of pneumonia. In these more difficult cases, serial chest imaging test results must be examined to help separate infectious from non-infectious pulmonary processes. To help confirm difficult cases, it may be useful to review multiple imaging test results spanning over several calendar days. Pneumonia may have rapid onset and progression, but does not resolve quickly. Imaging test evidence of pneumonia will persist. Rapid imaging resolution suggests that the patient does not have pneumonia, but rather a non-infectious process such as atelectasis or congestive heart failure.

2. Note that there are many ways of describing the imaging appearance of pneumonia. Examples include, but are not limited to, "air-space disease", "focal opacification", "patchy areas of increased density". Although perhaps not specifically delineated as pneumonia by the radiologist, in the appropriate clinical setting these alternative descriptive wordings should be seriously considered as potentially positive findings.

3. Purulent sputum is defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field (x100). Refer to the table below if your laboratory reports these data semi-quantitatively or uses a different format for reporting Gram stain or direct examination results (e.g., "many WBCs" or "few squamous epithelial cells"). This laboratory confirmation is required since written clinical descriptions of purulence are highly variable.

How do I use the purulent respiratory secretions criterion if …	**Instruction**
My laboratory reports counts of "white blood cells" or "polymorphonuclear leukocytes" or "leukocytes" rather than counts of "neutrophils"?	Assume that counts of cells identified by these other descriptors (e.g., "white blood cells") are equivalent to counts of neutrophils, unless the laboratory tells you this is not the case.
My laboratory reports semi-quantitative results (not quantitative results) for numbers of neutrophils and squamous epithelial cells?	Check with the laboratory to get information about what quantitative ranges the semi-quantitative reports correspond to.
My laboratory cannot provide additional information on how its semi-quantitative reporting corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells?	Use the following direct examination results to meet the purulent respiratory secretions criterion: heavy, 4+, or ≥25 neutrophils per low power field (lpf) [x100], AND rare, occasional, few, 1+ or 2+, or ≤10 squamous epithelial cells per lpf [x100] [19].
My laboratory reports only the numbers of neutrophils present, without reporting the number of squamous epithelial cells?	In this situation, the purulent secretions criterion may be met using the specified quantitative and semi-quantitative thresholds for neutrophils alone (i.e., heavy, 4+, or ≥25 neutrophils per lpf [x100]).
My laboratory uses different reporting thresholds for neutrophils and squamous epithelial cells (e.g., maximum report of ≥ 20 neutrophils per low power field [x100], or minimum report of ≤ 15 squamous epithelial cells per low power field [x100])?	In this situation, the purulent secretions criterion may be met using the laboratory's specified maximum quantitative threshold for neutrophils, and/or minimum quantitative threshold for squamous epithelial cells.

How do I use the purulent respiratory secretions criterion if …	Instruction
My laboratory processes respiratory specimens such as bronchoalveolar lavage fluid using a centrifugation procedure (e.g., "cytospin"), and there is no quantitation or semi-quantitation of neutrophils or white blood cells in the direct examination report?	In this situation, a report indicating the presence of white blood cells, without quantitation, is sufficient to meet the purulent secretions criterion.

4. Change in character of sputum refers to the color, consistency, odor and quantity.

5. In adults, tachypnea is defined as respiration rate >25 breaths per minute. Tachypnea is defined as >75 breaths per minute in premature infants born at <37 weeks gestation and until the 40th week; >60 breaths per minute in patients <2 months old; >50 breaths per minute in patients 2-12 months old; and >30 breaths per minute in children >1 year old.

6. Rales may be described as "crackles".

7. This measure of arterial oxygenation is defined as the ratio of the arterial tension (PaO_2) to the inspiratory fraction of oxygen (FiO_2).

8. Coagulase-negative *Staphylococcus* species, *Enterococcus* species and *Candida* species or yeast not otherwise specified that are cultured from blood from an immunocompetent patient cannot be deemed secondary to a PNEU, unless the organism was also cultured from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube) or lung tissue. *Candida* species isolated from sputum or endotracheal aspirate specimen combined with a matching blood culture can be used to satisfy the PNU3 definition for immunocompromised patients.

9. Refer to threshold values for cultured specimens with growth of eligible pathogens. (Table 5).

Note: a sputum and endotracheal aspirate are not minimally- contaminated specimens and therefore, organisms isolated from these specimens do not meet the laboratory criteria for PNU2.

Because they are an indication of commensal flora of the oral cavity or upper respiratory tract, the following organisms can only be used to meet PNEU definitions when isolated from pleural fluid obtained during thoracentesis or initial placement of chest tube (not from an indwelling chest tube) or lung tissue:

- Coagulase-negative *Staphylococcus* species
- *Enterococcus* species
- *Candida* species or yeast not otherwise specified. *Candida* species combined with a matching blood culture can be used to meet the PNU3 definition.

10. Immunocompromised patients include those with neutropenia (absolute neutrophil count or total white blood cell count (WBC) <500/mm^3), leukemia, lymphoma, HIV with CD4 count <200, or splenectomy; those who are early post-transplant, are on cytotoxic chemotherapy, or are on high dose steroids (e.g., >40mg of prednisone or its equivalent (>160mg hydrocortisone, >32mg methylprednisolone, >6mg dexamethasone, >200mg cortisone) daily for >2weeks).

11. Cultures of blood and sputum or endotracheal aspirate must have a collection date that occurs within the Infection Window Period.

12. Semi-quantitative or non-quantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage are acceptable. If quantitative culture results from minimally-contaminated LRT specimen are available, refer to criteria that include such specific laboratory findings.

Figure 1: Pneumonia Flow Diagram for Patients of Any Age

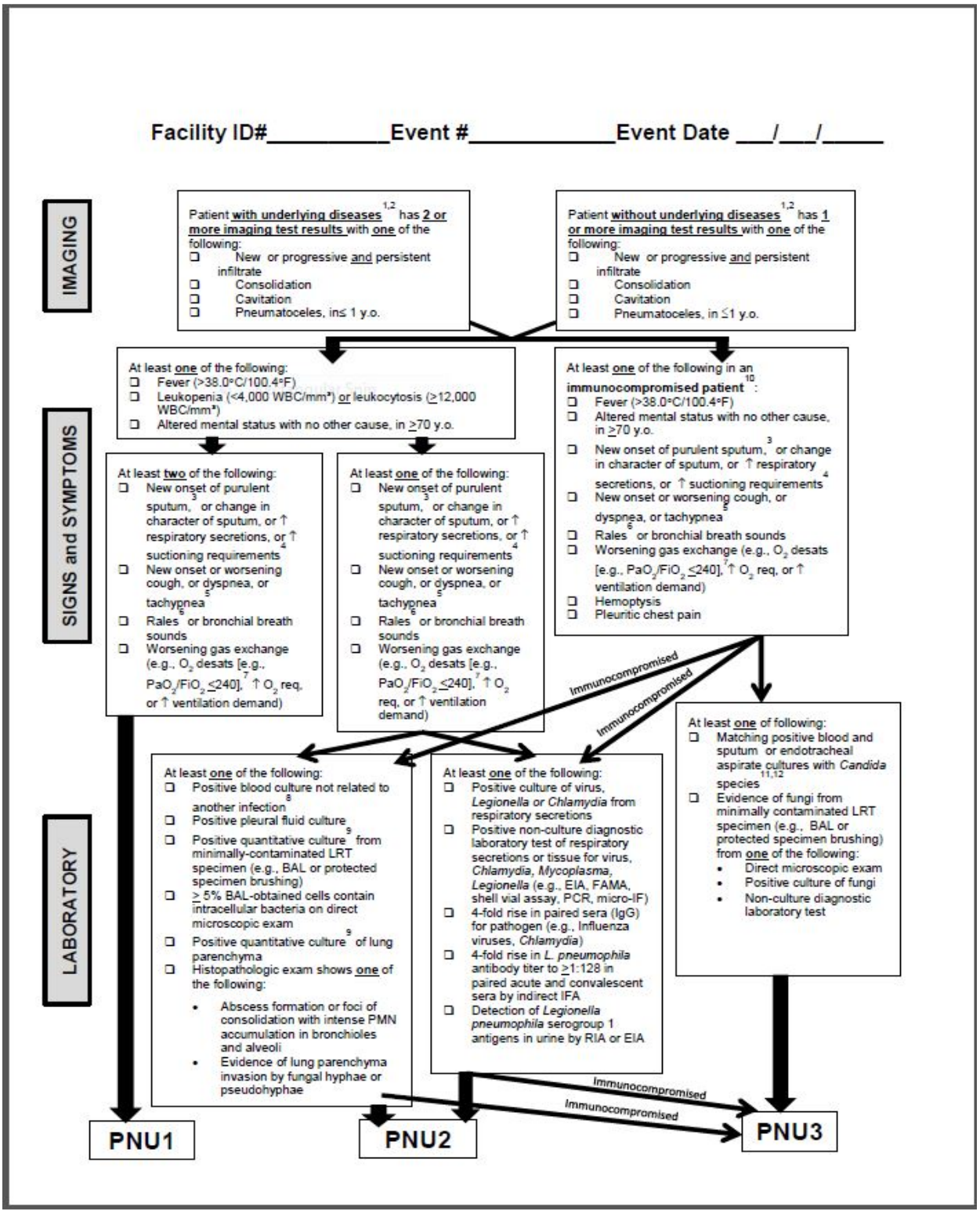


Figure 2: Pneumonia Flow Diagram, Alternative Criteria for Infants and Children

Facility ID#_____Event #_____Event Date __/__/____

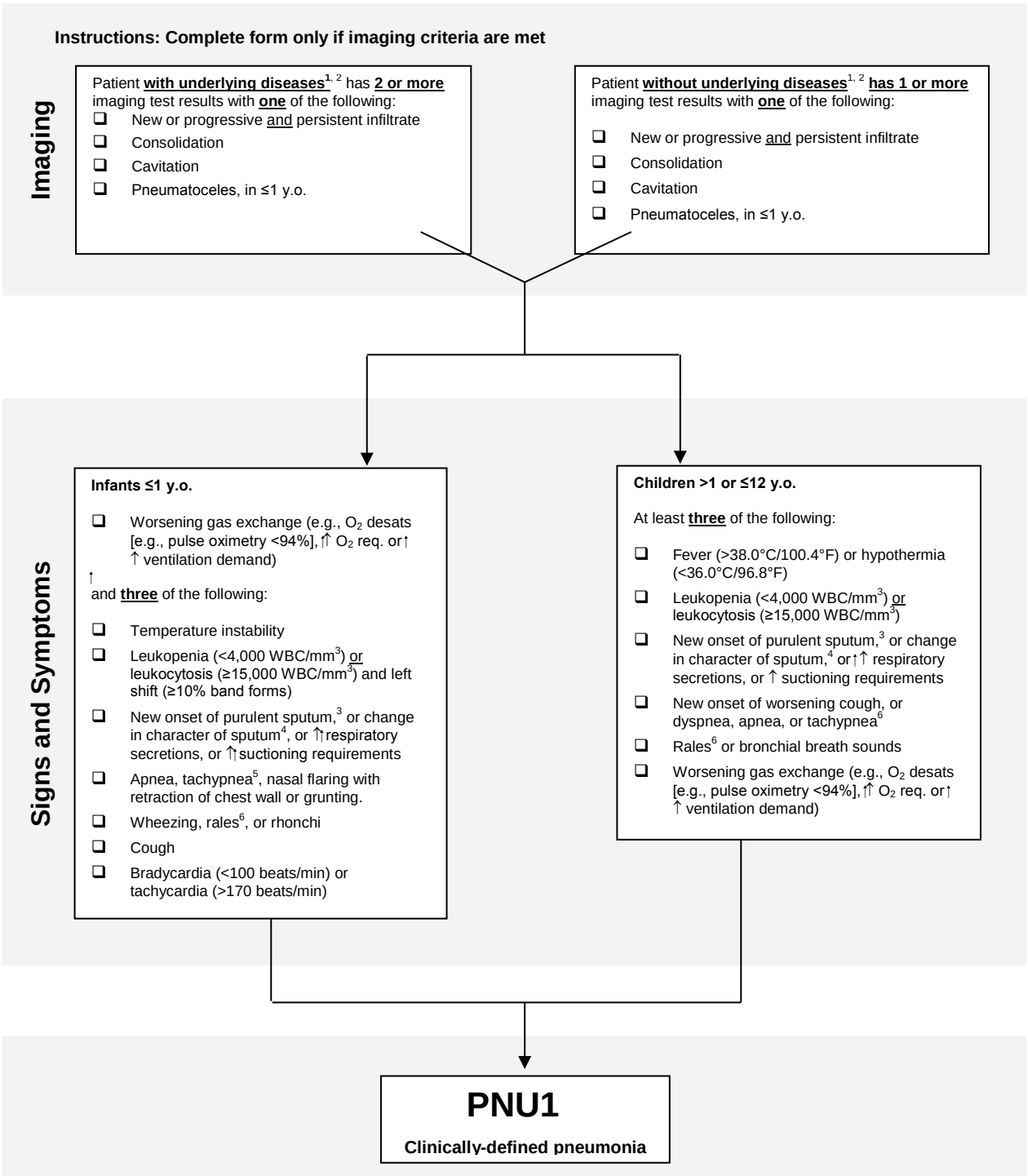


Table 5: Threshold values for cultured specimens used in the diagnosis of pneumonia

Specimen collection/technique	**Values**†
Lung tissue*	≥10^4 CFU/g tissue
Bronchoscopically (B) obtained specimens	
Bronchoalveolar lavage (B-BAL)	≥10^4 CFU/ml
Protected BAL (B-PBAL)	≥10^4 CFU/ml
Protected specimen brushing (B-PSB)	≥10^3 CFU/ml
Nonbronchoscopically (NB) obtained (blind) specimens	
NB-BAL	>10^4 CFU/ml
NB-PSB	≥10^3 CFU/ml

CFU = colony forming units
g = gram
ml = milliliter

* Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or transbronchial biopsy
† Consult with your laboratory to determine if reported semi-quantitative results match the quantitative thresholds. In the absence of additional information available from your laboratory, a semi-quantitative result of "moderate" or "heavy" growth, or 2+, 3+ or 4+ growth is considered to correspond.

Numerator Data: The *Pneumonia (PNEU)* form (CDC 57.111) is used to collect and report each VAP that is identified during the month selected for surveillance. The Instructions for Completion of Pneumonia (PNEU) form contains brief instructions for collection and entry of each data element on the form. The pneumonia form includes patient demographic information and information on whether or not mechanically-assisted ventilation was present. Additional data include the specific criteria met for identifying pneumonia, whether the patient developed a secondary bloodstream infection, whether the patient died, the organisms isolated from cultures, and the organisms' antimicrobial susceptibilities.

Reporting Instruction:
If no VAPs are identified during the month of surveillance, the "*Report No Events"* box must be checked on the appropriate denominator summary screen, e.g., Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or SCA/ONC), etc.

Denominator Data: Device days and patient days are used for denominators (see Key Terms chapter). Ventilator days, which are the number of patients managed with a ventilatory device, are collected daily, at the same time each day, according to the chosen

location using the appropriate form (CDC 57.116, 57.117, and 57.118). These daily counts are summed and only the total for the month is entered into NHSN. Ventilator days and patient days are collected for each of the locations where VAP is monitored. When denominator data are available from electronic sources (e.g., ventilator days from respiratory therapy), these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected counts, validated for a minimum of three months.

Data Analyses: The VAP rate per 1000 ventilator days is calculated by dividing the number of VAPs by the number of ventilator days and multiplying the result by 1000. The Ventilator Utilization Ratio is calculated by dividing the number of ventilator days by the number of patient days. These calculations will be performed separately for the different types of ICUs, SCAs, and other locations in the institution.

The Standardized Infection Ratio (SIR[4]) is another measure of VAP incidence that can be calculated by dividing the number of observed infections by the number of predicted infections. The number of predicted infections can be calculated using VAP rates from a standard population during a baseline time period, which represents a standard population's VAP experience.[5]

Note: The SIR should be calculated only if the number of expected HAIs (numExp) is ≥1 in order to enforce a minimum precision criterion

Note: The VAP SIR is not available from within the NHSN application, but can be calculated using the methods described above.

While the VAP SIR can be calculated for single locations, the measure also allows you to summarize your data by multiple locations, adjusting for differences in the incidence of infection among the location types. For example, you can calculate one VAP SIR adjusting for all locations reported. Similarly, you can calculate one VAP SIR for all oncology locations in your facility.

Descriptive analysis options of numerator and denominator data are available in the NHSN application, such as line listings, frequency tables, and bar and pie charts. VAP rates and run charts are also available. Guides on using NHSN analysis features are available from: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

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Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events

Introduction: Urinary tract infections (UTIs) are tied with pneumonia as the second most common type of healthcare-associated infection, second only to SSIs and account for more than 15% of infections reported by acute care hospitals[1]. Virtually all healthcare-associated UTIs are caused by instrumentation of the urinary tract.

CAUTI can lead to such complications as prostatitis, epididymitis, and orchitis in males, and cystitis, pyelonephritis, gram-negative bacteremia, endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis in all patients. Complications associated with CAUTI cause discomfort to the patient, prolonged hospital stay, and increased cost and mortality[2]. It has been estimated that each year, more than 13,000 deaths are associated with UTIs.[3]

Prevention of CAUTI is discussed in the CDC/HICPAC document, *Guideline for Prevention of Catheter-associated Urinary Tract Infection*[4].

Settings: Surveillance may occur in any inpatient location(s) where denominator data can be collected, such as critical intensive care units (ICU), specialty care areas (SCA), step- down units, wards, inpatient rehabilitation locations, and long term care locations. Neonatal ICUs may participate, but only off plan (not as a part of their monthly reporting plan). A complete listing of inpatient locations and instructions for mapping can be found in the CDC Locations and Descriptions chapter.

Note: It is not required to monitor for CAUTIs after the patient is discharged from the facility. However, if discovered, any CAUTI with the date of event on the day of discharge or the next day should be reported to NHSN. No additional indwelling catheter days are reported.

Definitions:

Present on Admission (POA): Infections that are POA, as defined in Chapter 2, are not considered HAIs and therefore are never reported to NHSN.

Healthcare-associated infections (HAI): All NHSN site specific infections must first meet the HAI definition as defined in Chapter 2 before a site specific infection (e.g., CAUTI) can be reported to NHSN.

Urinary tract infections (UTI) are defined using Symptomatic Urinary Tract Infection (SUTI) criteria, Asymptomatic Bacteremic UTI (ABUTI), or Urinary System Infection (USI) criteria (See Table 1 and Figure 3).

Date of event (DOE): For a UTI, the date of event is the date when the first element used to meet the UTI infection criterion occurred for the first time within the 7-day Infection Window Period. Synonyms: infection date, event date.

Indwelling catheter: A drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a drainage bag (including leg bags). These devices are also called Foley catheters. Condom or straight in-and-out catheters are not included nor are nephrostomy tubes, ileoconduits, or suprapubic catheters unless a Foley catheter is also present. Indwelling urethral catheters that are used for intermittent or continuous irrigation are included in CAUTI surveillance.

Catheter-associated UTI (CAUTI): A UTI where an indwelling urinary catheter was in place for >2 calendar days on the date of event, with day of device placement being
Day 1,
AND
an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for > 2 calendar days and then removed, the date of event for the UTI must be the day of discontinuation or the next day for the UTI to be catheter-associated.

Example of Associating Catheter Use to UTI:
A patient in an inpatient unit has a Foley catheter inserted and the following day is the date of event for a UTI. Because the catheter has not been in place >2 calendar days on the date of event, this is not a CAUTI. However, depending on the date of admission, this may be a healthcare-associated UTI.

Notes:

- SUTI 1b and USI cannot be catheter-associated.
- Indwelling urinary catheters that are removed and reinserted: If, after indwelling urinary catheter removal, the patient is without an indwelling urinary catheter for at least 1 full calendar day (NOT to be read as 24 hours), then the urinary catheter day count will start anew. If instead, a new indwelling urinary catheter is inserted before a full calendar day has passed without an indwelling urinary catheter being present, the urinary catheter day count will continue.

Figure 1: Associating Catheter Use to UTI

	March 31 (Hospital day 3)	April 1	April 2	April 3	April 4	April 5	April 6
Patient A	Foley **Day 3**	Foley **Day 4**	Foley removed **(Foley Day 5)**	Foley replaced **(Foley Day 6)**	Foley **Day 7**	Foley removed **Day 8**	No Foley
Patient B	Foley **Day 3**	Foley **Day 4**	Foley removed **(Foley Day 5)**	No Foley	Foley replaced (**Foley Day 1)**	Foley **Day 2**	Foley **Day 3**

Rationale: NHSN surveillance for infection is not aimed at a specific device. Instead surveillance is aimed at identifying risk to the patient that is the result of device use in general.

- In the examples above, Patient A is eligible for a CAUTI beginning on March 31, through April 6th, since a Foley was in place for some portion of each calendar day until April 6th. A UTI with date of event on April 6th would be a CAUTI since the catheter had been in place greater than 2 days and was removed the day before the date of event.

- Patient B is eligible for a CAUTI on March 31 (Foley Day 3) through April 3. The catheter had been in place > 2 days and an HAI occurring on the day of device discontinuation or the following calendar day is considered a device-associated infection.

Location of attribution: The inpatient location where the patient was assigned on the date of the UTI event. See Date of Event definition (above). See Exception to Location of Attribution (below).

Exception to Location of Attribution

Transfer Rule: If the date of event for a CAUTI is on the date of transfer or discharge, or the next day, the infection is attributed to the transferring/discharging location. This is called the Transfer Rule and examples are shown below. Receiving facilities should share information about such HAIs with the transferring location or facility to enable reporting.

Examples of the Transfer Rule:

- Patient in the SICU with a Foley catheter, which has been in place for 5 days, is transferred to a surgical ward. The next day is determined to be the date of event for a CAUTI. This is reported to NHSN as a CAUTI for the SICU.
- Patient is transferred in the morning to the medical ward from the MSICU after having the Foley catheter removed, which had been in place for 6 days. Later that night, the patient experiences urinary frequency and the next day, all other UTI criteria are met. This is reported to NHSN as a CAUTI for the MSICU as the date of event (date when the first element of UTI criteria, first appeared during the infection window) was the day of transfer from that location.
- On Monday, patient with a Foley catheter in place is transferred from the medical ward to the coronary care unit (CCU). Wednesday in the CCU, patient has a fever and urine culture collected that day is positive for 100,000 CFU/ml of *E. coli*. This is reported to NHSN as a CAUTI for the CCU, as the UTI event date is LATER THAN the day after transfer.
- A patient has a Foley catheter removed on catheter day 5 and is discharged the same day from hospital A's urology ward. The next day, the IP from Hospital B calls to report that this patient has been admitted to Hospital B meeting UTI criteria. This CAUTI should be reported to NHSN for Hospital A and attributed to the urology ward.

Multiple Transfers

In instances where a patient has been transferred to more than one location on the date of a UTI, or the day before, attribute the UTI to the **first** location in which the patient was housed the **day before** the UTI's date of event.

Figure 2: Multiple Transfers within the Transfer Rule Time Frame

	3/22	3/23	3/24
Locations in which patient was housed	Unit A	Unit A Unit B Unit C	Unit C Unit D This is also the date of event for a CAUTI. CAUTI is attributed to Unit A since Unit A was the first location in which the patient was housed the day before the date of event.

Table 1: Urinary Tract Infection Criteria

Criterion	Urinary Tract Infection (UTI)
	Symptomatic UTI (SUTI) Must meet at least ***one*** of the following criteria:
SUTI 1a **Catheter-associated Urinary Tract Infection** **(CAUTI)**	Patient must meet 1, 2, and 3 below: 1. Patient has an indwelling urinary catheter **in place for the entire day on the date of event** and such catheter had been in place for >2 calendar days, on that date (day of device placement = Day 1) 2. Patient has at least ***one*** of the following signs or symptoms: • fever (>38.0°C) • suprapubic tenderness***** • costovertebral angle pain or tenderness* 3. Patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of $\geq 10^5$ CFU/ml. All elements of the UTI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN). **----------OR----------** Patient must meet 1, 2, and 3 below: 1. Patient had an indwelling urinary catheter in place for >2 calendar days which was **removed on the day of, or day before the date of event** 2. Patient has at least ***one*** of the following signs or symptoms: • fever (>38.0°C) • suprapubic tenderness***** • costovertebral angle pain or tenderness* • urinary urgency* • urinary frequency* • dysuria* 3. Patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of $\geq 10^5$ CFU/ml. All elements of the UTI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN). *****With no other recognized cause **Note:** Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from UTI determination because they are clinically deemed due to another recognized cause.

SUTI 1b **Non-Catheter-associated Urinary Tract Infection (Non-CAUTI)**	Patient must meet 1, 2, and 3 below: 1. One of the following is true: • Patient has/had an indwelling urinary catheter but it has/had not been in place >2 calendar days, **OR** • Patient did not have a urinary catheter in place on the date of event nor the day before the date of event 2. Patient has at least ***one*** of the following signs or symptoms: • fever (>38°C) in a patient that is ≤ 65 years of age • suprapubic tenderness***** • costovertebral angle pain or tenderness***** • urinary frequency* • urinary urgency* • dysuria* 3. Patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of $\geq 10^5$ CFU/ml. All elements of the SUTI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN). *****With no other recognized cause **Notes:** • An indwelling urinary catheter in place at the time would constitute other recognized cause for patient complaints of "frequency" "urgency" or "dysuria" and therefore these cannot be used as symptoms when catheter is in place. • Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from UTI determination because they are clinically deemed due to another recognized cause.

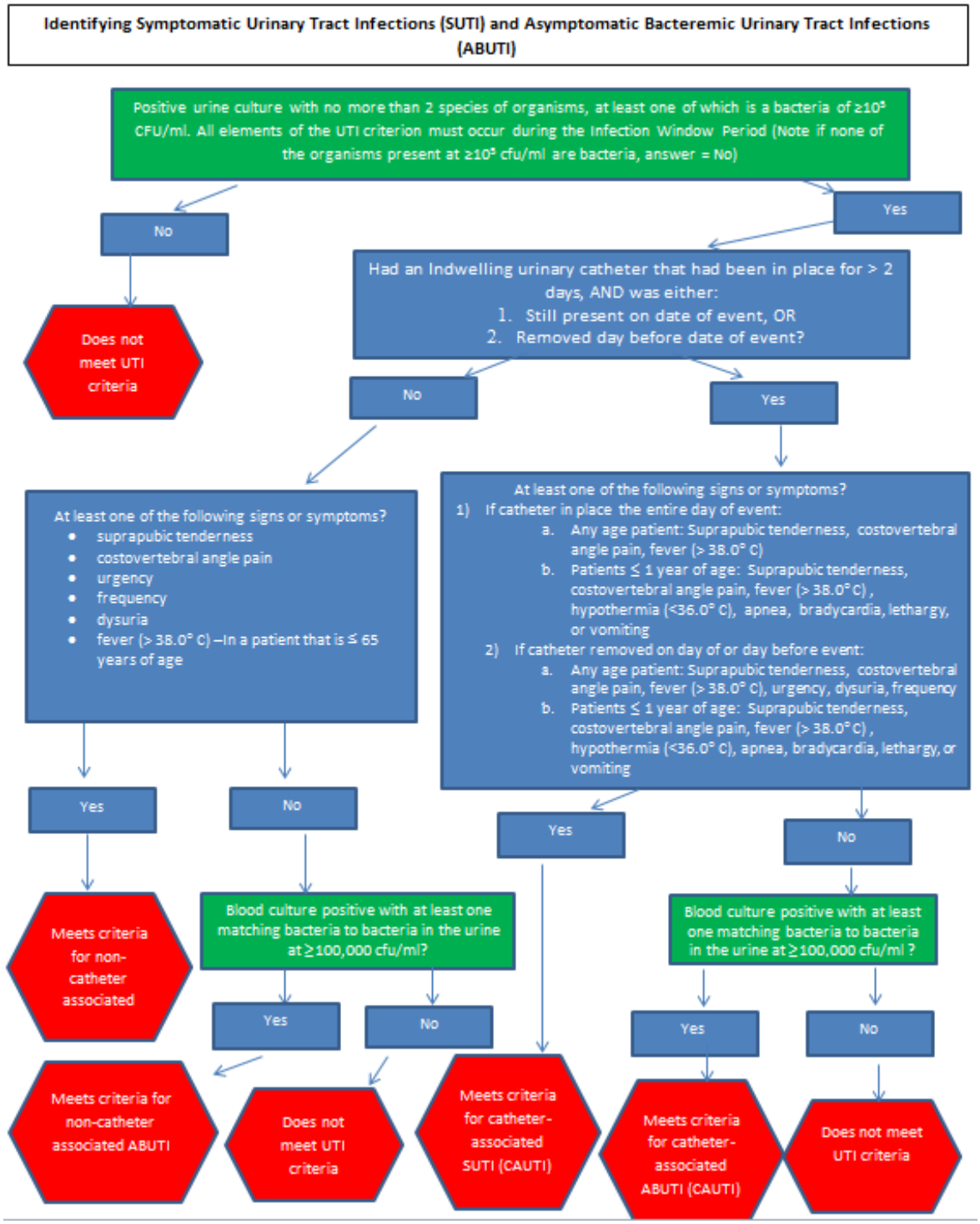
SUTI 2 **CAUTI or Non-CAUTI in patients 1 year of age or less-**	Patient must meet 1, 2, <u>and</u> 3 below: 1. Patient is ≤1 year of age (with‡ or without an indwelling urinary catheter) 2. Patient has at least ***<u>one</u>*** of the following signs or symptoms: • fever (>38.0°C) • hypothermia (<36.0°C) • apnea***** • bradycardia***** • lethargy***** • vomiting* • suprapubic tenderness* 3. Patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of ≥10^5 CFU/ml. All elements of the SUTI criterion must occur during the Infection Window Period (See Definition <u>Chapter 2 Identifying HAIs in NHSN).</u> *****With no other recognized cause ‡ If patient had an indwelling urinary catheter in place for >2 calendar days, and catheter was in place on the date of event or the previous day the CAUTI criterion is met. If no such indwelling urinary catheter was in place, UTI (non-catheter associated) criterion is met. **Note:** Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from UTI determination because they are clinically deemed due to another recognized cause.

	Asymptomatic Bacteremic Urinary Tract Infection (ABUTI)
	Patient must meet 1, 2, and 3 below: 1. Patient with***** or without an indwelling urinary catheter has no signs or symptoms of SUTI 1 or 2 according to age (**Note**: Patients > 65 years of age with a non-catheter-associated ABUTI **may** have a fever and still meet the ABUTI criterion) 2. Patient has a urine culture with no more than two species of organisms, at least one of which is a bacteria of $\geq 10^5$ CFU/ml (see Comment section below) 3. Patient has a positive blood culture with at least ***one*** matching bacteria to the urine culture, or meets LCBI criterion 2 (without fever) and matching common commensal(s) in the urine. All elements of the ABUTI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN). *****Patient had an indwelling urinary catheter in place for >2 calendar days, with day of device placement being Day 1, and catheter was in place on the date of event or the day before.
Comment	"Mixed flora" is not available in the pathogen list within NSHN. Therefore it cannot be reported as a pathogen to meet the NHSN UTI criteria. Additionally, "mixed flora" represent at least two species of organisms. Therefore an additional organism recovered from the same culture, would represent >2 species of microorganisms. Such a specimen also cannot be used to meet the UTI criteria.

Criterion	**Urinary System Infection (USI) (formerly OUTI) (kidney, ureter, bladder, urethra, or tissue surrounding the retroperitoneal or perinephric space)** Other infections of the urinary tract must meet at least ***one*** of the following criteria:
	1. Patient has microorganisms isolated from culture of fluid (excluding urine) or tissue from affected site. 2. Patient has an abscess or other evidence of infection on gross anatomical exam, during invasive procedure, or on histopathologic exam 3. Patient has at least ***one*** of the following signs or symptoms: • fever (>38.0°C) • localized pain or tenderness* **And at least *one* of the following:** • purulent drainage from affected site • organisms cultured from blood and imaging test evidence of infection (e.g., ultrasound, CT scan, magnetic resonance imaging [MRI], or radiolabel scan [gallium, technetium]) 4. Patient ≤1 year of age has at least ***one*** of the following signs or symptoms: • fever (>38.0°C) • hypothermia (<36.0°C) • apnea* • bradycardia* • lethargy* • vomiting* **And at least *one* of the following:** • purulent drainage from affected site • organisms cultured from blood and imaging test evidence of infection, (e.g., ultrasound, CT scans, magnetic resonance imaging [MRI], or radiolabel scan [gallium, technetium]) * With no other recognized cause

	Notes: • Fever and hypothermia are non-specific symptoms of infection and cannot be excluded from UTI determination because they are clinically deemed due to another recognized cause. • All elements of the USI criterion must occur during the Infection Window Period (See Definition Chapter 2 Identifying HAIs in NHSN).
Comments	• Report infections following circumcision in newborns as SST-CIRC. • If patient meets USI criteria and they also meet UTI criteria, report UTI only, unless the USI is a surgical site organ/space infection, in which case, only USI should be reported. • For NHSN reporting purposes, Urinary System Infection (USI) cannot be catheter associated, therefore, USI will only present as specific event type if urinary catheter status is marked "Neither".

Figure 3: Identifying SUTI and ABUTI Flowchart



Numerator Data: The *Urinary Tract Infection (UTI)* form is used to collect and report each CAUTI that is identified during the month selected for surveillance. The Instructions for Completion of Urinary Tract Infection form include brief instructions for collection and entry of each data element on the form. USIs are never included in CAUTI data and are reported separately on the HAI Custom Event Form. The UTI form includes patient demographic information and information on whether or not an indwelling urinary catheter was present. Additional data include the specific criteria met for identifying the UTI, whether the patient developed a secondary bloodstream infection, whether the patient died, and the organisms isolated from cultures and their antimicrobial susceptibilities.

Reporting Instructions:
If no CAUTIs are identified during the month of surveillance, the" Report No Events" box must be checked on the appropriate denominator summary screen, (e.g., *Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or SCA/ONC).*

Denominator Data: Device days and patient days are used for denominators (See Key Terms chapter).The method of collecting device-day denominator data may differ depending on the location of patients being monitored. The following methods may be used:

Denominator Data Collection Method	**Details**
Manual, Daily (i.e., collected at the same time every day of the month)	Denominator data are collected at the same time, every day, per location. Indwelling urinary catheter days, which are the number of patients with an indwelling urinary catheter device, are collected daily, at the same time each day, according to the chosen location using the appropriate form (CDC 57.117 and 57.118). These daily counts are summed and only the total for the month is entered into NHSN. Indwelling urinary catheter days and patient days are collected separately for each of the locations monitored.
Manual, sampled once/week (i.e., collected at the same time on the same designated day, once per week)	For locations other than specialty care areas/oncology (SCA/ONC) and NICUs (e.g., ICUs, step-down units, wards), the denominator sampling method can be used. To reduce staff time spent collecting surveillance data, once weekly sampling of denominator data to generate estimated urinary catheter days may be used as an alternative to daily collection in non-oncology ICUs and wards. The number of patients in the location (patient-days) and the number of patients with an indwelling urinary catheter (urinary catheter-days) is collected on a designated day each week (e.g., every Tuesday), at the same time during the month.

Denominator Data Collection Method	Details
	Evaluations of this method have repeatedly shown that use of Saturday or Sunday generate the least accurate estimates of denominator data, and, therefore, these days should not be selected as the designated day.[5-7] If the day designated for the collection of sampled data is missed, collect the data on the next available day instead. The following must be collected and entered into NHSN: 1. The monthly total for patient-days, based on collection daily 2. The sampled total for patient-days 3. The sampled total urinary catheter-days When these data are entered, the NHSN application will calculate an estimate of urinary catheter-days. **Notes:** • To ensure the accuracy of estimated denominator data obtained by sampling, only ICU and ward location types with an average of 75 or more urinary catheter-days per month are eligible to use this method. A review of each location's urinary catheter denominator data for the past 12 months in NHSN will help determine which locations are eligible. • The accuracy of estimated denominator data generated by sampling can be heavily influenced by incorrect or missing data. Careful implementation of data collection following the guidance in this protocol is essential to avoid erroneous fluctuations in rates or Standardized Infection Ratios (SIRs).
Electronic	For ***any*** location, when denominator data are available from electronic sources (e.g., urinary catheter days from electronic charting), these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected, once a day counts, pre-validated for a minimum of three months. The validation of electronic counts should be performed for each location separately.

Data Analyses: The Standardized Infection Ratio (SIR) is calculated by dividing the number of observed infections by the number of predicted infections. The number of predicted infections is calculated using CAUTI rates from a standard population during a baseline time period, which represents a standard population's CAUTI experience.[8, 9]

Notes:

- The SIR will be calculated only if the number of predicted CAUTIs (numExp) is ≥1 to help enforce a minimum precision criterion.
- In the NHSN application, "predicted" is referred to as "expected".

$$\text{SIR} = \frac{\text{Observed (O) HAIs}}{\text{Expected (E) HAIs}}$$

While the CAUTI SIR can be calculated for single locations, the measure also allows you to summarize your data by multiple locations, adjusting for differences in the incidence of infection among the location types. For example, you will be able to obtain one CAUTI SIR adjusting for all locations reported. Similarly, you can obtain one CAUTI SIR for all ICUs in your facility.

Note: Only those locations for which baseline data have been published will be included in the SIR calculations. For acute care hospitals, the baseline time period is 2009; for long term acute care hospitals and inpatient rehabilitation facilities (IRFs) and IRF units, the baseline time period is 2013.[8,9]

The CAUTI rate per 1000 urinary catheter days is calculated by dividing the number of CAUTIs by the number of catheter days and multiplying the result by 1000. The Urinary Catheter Utilization Ratio is calculated by dividing the number of urinary catheter days by the number of patient days. These calculations will be performed separately for the different types of ICUs, specialty care areas, and other locations in the institution, except for neonatal locations.

Descriptive analysis output options of numerator and denominator data, such as line listings, frequency tables, and bar and pie charts are available in the NHSN application. SIRs and CAUTI rates and run charts are also available. Guides on using NHSN analysis features are available at: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

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Ventilator-Associated Event (VAE)

For use in adult locations only

Table of Contents:

Introduction: Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure. Studies have estimated that more than 300,000 patients receive mechanical ventilation in the United States each year [1-3]. These patients are at high risk for complications and poor outcomes, including death [1-5]. Ventilator-associated pneumonia (VAP), sepsis, Acute Respiratory Distress Syndrome (ARDS), pulmonary embolism, barotrauma, and pulmonary edema are among the complications that can occur in patients receiving mechanical ventilation; such complications can lead to longer duration of mechanical ventilation, longer stays in the ICU and hospital, increased healthcare costs, and increased risk of disability and death. Mortality in patients with acute lung injury on mechanical ventilation has been estimated to range from 24% in persons 15-19 years of age to 60% for patients 85 years and older [4].

Surveillance for ventilator-associated events in the National Healthcare Safety Network (NHSN) prior to 2013 was limited to VAP. For the year 2012, VAP incidence for various types of hospital units ranged from 0.0-4.4 per 1,000 ventilator days [6]. However, there is currently no valid, reliable definition for VAP, and even the most widely-used VAP criteria and definitions are neither sensitive nor specific [7-10].

A particular difficulty with many commonly-used VAP definitions, including the NHSN PNEU definitions (revised in 2002), is that they require radiographic findings of pneumonia. Evidence suggests that chest radiograph findings do not accurately identify VAP. The subjectivity and

variability inherent in chest radiograph technique, interpretation, and reporting make chest imaging ill-suited for inclusion in a definition algorithm to be used for the potential purposes of public reporting, inter-facility comparisons, and pay-for-reporting and pay-for-performance programs. Another major difficulty with available VAP definitions is their reliance on specific clinical signs or symptoms, which are subjective and may be poorly or inconsistently documented in the medical record. The NHSN PNEU protocol includes multiple definition pathways and special criteria for selected patient populations (e.g., children, immunocompromised patients), increasing its complexity.

The limitations of VAP surveillance definitions have implications for prevention. Valid and reliable surveillance data are necessary for assessing the effectiveness of prevention strategies. It is notable that some of the most effective measures for improving outcomes of patients on mechanical ventilation do not specifically target pneumonia prevention [11-14].

In 2011 CDC convened a Working Group composed of members of several stakeholder organizations to address the limitations of the NHSN PNEU definitions and propose a new approach to surveillance for Ventilator-Associated Events (VAE) for NHSN [15]. The organizations represented in the Working Group include: the Critical Care Societies Collaborative (the American Association of Critical-Care Nurses, the American College of Chest Physicians, the American Thoracic Society, and the Society for Critical Care Medicine); the American Association for Respiratory Care; the Association of Professionals in Infection Control and Epidemiology; the Council of State and Territorial Epidemiologists; the Healthcare Infection Control Practices Advisory Committee's Surveillance Working Group; the Infectious Diseases Society of America; and the Society for Healthcare Epidemiology of America.

The VAE surveillance definition algorithm developed by the Working Group and implemented in the NHSN in January 2013 is based on objective, streamlined, and potentially automatable criteria that identify a broad range of conditions and complications occurring in mechanically-ventilated adult patients [16]. Several modifications to the VAE definitions have been made since January 2013. These modifications address issues raised by NHSN users and discussed with the Working Group. There are three definition tiers within the VAE algorithm: 1) Ventilator-Associated Condition (VAC); 2) Infection-related Ventilator-Associated Complication (IVAC); and 3) Possible VAP (PVAP). Data indicate that streamlined, objective algorithms to detect ventilator-associated complications (similar to the VAC tier of the VAE algorithm) are easily implemented, can make use of electronic health record systems to automate event detection, and identify events that are clinically important and associated with outcomes such as ICU and hospital length of stay and mortality [16,17]. Research suggests that most VACs are due to pneumonia, ARDS, atelectasis, and pulmonary edema [16]. These are significant clinical conditions that may be preventable.

NOTE: The VAE definition algorithm is for use in surveillance; it is not a clinical definition algorithm and is not intended for use in the clinical management of patients. Examples provided throughout this protocol and in the VAE "Frequently-Asked Questions" are for illustration purposes only and are not intended to represent actual clinical scenarios.

Settings: Inpatient locations eligible to participate in VAE surveillance are those adult locations in acute care hospitals, long term acute care hospitals, and inpatient rehabilitation facilities where denominator data (ventilator and patient days) can be collected for patients. Such locations may include critical/intensive care units (ICU), specialty care areas (SCA), step-down units, wards, and long term care units. A complete listing of adult inpatient locations can be found in Chapter 15.

NOTE: It is not required to monitor for VAEs after discharge if a patient is transferred to another facility while still on mechanical ventilation. However, VAEs discovered within 2 calendar days of discharge (where the day of discharge is day 1) should be reported to NHSN. No additional ventilator days are reported.

Definitions:

VAE: VAEs are identified by using a combination of objective criteria: deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection. The following pages outline the criteria that must be used for meeting the VAE surveillance definitions (Figures 1-4). To report VAEs, use the *Ventilator-Associated Event* form (CDC 57.112) and *Instructions for Completion*.

> NOTE: Patients must be mechanically ventilated for more than 2 calendar days to be eligible for VAE. The earliest day on which VAE criteria can be fulfilled is day 4 of mechanical ventilation (where the day of intubation and initiation of mechanical ventilation is day 1). The earliest date of event for VAE (the date of onset of worsening oxygenation) is day 3 of mechanical ventilation. Line lists of VAE data elements demonstrating scenarios that meet and do not meet the VAE definitions are presented in "Frequently-Asked Questions (FAQs)" number (no.) 2 at the end of this chapter.
>
> NOTE: The baseline period of stability or improvement on the ventilator is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2, and must be characterized by ≥ 2 calendar days of stable or decreasing daily minimum FiO_2 or PEEP values (i.e., the daily minimum PEEP or FiO_2 on the second day of the baseline period of stability or improvement must be equal to or less than the daily minimum PEEP or FiO_2 on the first day of the baseline period of stability or improvement). The definitions of "daily minimum PEEP" and "daily minimum FiO_2" are included below. Note that the minimum daily PEEP or FiO2 used for VAE surveillance is

the lowest setting during a calendar day that was maintained for at least 1 hour (see daily minimum PEEP and FiO2 definitions for exception to 1 hour requirement).

For the purposes of VAE surveillance, PEEP values between 0 cmH_2O and 5 cmH_2O will be considered equivalent. This means that patients with daily minimum PEEP values from 0 to 5 cmH_2O must then have an increase in the daily minimum PEEP to at least 8 cmH_2O, sustained for at least 2 calendar days, to meet the VAC definition.

EXAMPLE: In the example below, the baseline period is defined by mechanical ventilation (MV) days 1 through 4 (shaded in light gray), and the period of worsening oxygenation by MV days 5 and 6 (shaded in darker gray), where the daily minimum PEEP is $\geq$ 3 cmH_2O greater than the daily minimum PEEP during the baseline period. Note that there is no VAC on MV day 3, because PEEP values 0-5 cmH_2O are considered equivalent for the purposes of this surveillance.

MV Day	Daily minimum PEEP (cmH_2O)	Daily minimum FiO_2 (oxygen concentration, %)	VAE
1	0	1.00 (100%)	
2	0	0.50 (50%)	
3	**5**	0.50 (50%)	
4	**5**	0.50 (50%)	
5	**8**	0.50 (50%)	**VAC**
6	**8**	0.50 (50%)	

EXAMPLE: In the example below, the baseline period is defined by mechanical ventilation (MV) days 1 through 4 (shaded in light gray), and the period of worsening oxygenation by MV days 5 and 6 (shaded in darker gray), where the daily minimum PEEP is $\geq$ 3 cmH_2O greater than the daily minimum PEEP during the baseline period. In this example, note that MV days 1-4 are considered a baseline period even though the daily minimum PEEP increases from 0 to 3 to 5 cmH_2O during this time period—because PEEP values from 0-5 cmH_2O are considered equivalent for the purposes of this surveillance.

MV Day	Daily minimum PEEP (cmH_2O)	Daily minimum FiO_2 (oxygen concentration, %)	VAE
1	0	1.00 (100%)	
2	0	0.50 (50%)	
3	**3**	0.50 (50%)	
4	**5**	0.50 (50%)	
5	**8**	0.50 (50%)	**VAC**
6	**8**	0.50 (50%)	

EXAMPLE: In the example below, the baseline period is defined by mechanical ventilation (MV) days 3 and 4 (shaded in light gray), and the period of worsening oxygenation by MV days 5 and 6 (shaded in darker gray), where the daily minimum FiO_2 is $\geq$ 0.20 (20 points) over the daily minimum FiO_2 during the baseline period.

MV Day	Daily minimum PEEP (cmH_2O)	Daily minimum FiO_2 (oxygen concentration, %)	VAE
1	8	1.00 (100%)	
2	6	0.50 (50%)	
3	5	**0.40 (40%)**	
4	5	**0.40 (40%)**	
5	6	**0.70 (70%)**	**VAC**
6	6	**0.70 (70%)**	

EXAMPLE: In the example below, there is no VAC, because the FiO_2 on MV day 4 is higher than the FiO_2 on MV day 3 (and therefore not stable or decreasing) – even though the FiO_2 on MV days 3 and 4 meets the 20-point threshold when compared with the daily minimum FiO_2 on MV days 5 and 6.

MV Day	Daily minimum PEEP (cmH_2O)	Daily minimum FiO_2 (oxygen concentration, %)	VAE
1	8	1.0 (100%)	
2	6	0.50 (50%)	
3	5	0.35 (35%)	
4	5	0.40 (40%)	
5	6	0.70 (70%)	No event
6	6	0.70 (70%)	

NOTE: Patients on high frequency ventilation or extracorporeal life support are EXCLUDED from VAE surveillance.

NOTE: Patients who are receiving a conventional mode of mechanical ventilation while in the prone position and patients who are receiving a conventional mode of mechanical ventilation while receiving nitric oxide therapy, helium-oxygen mixtures (heliox) or epoprostenol therapy are INCLUDED in VAE surveillance.

NOTE: Patients on Airway Pressure Release Ventilation (APRV) or related modes (see FAQ nos. 22 and 23), are INCLUDED, but the VAE period of stability or improvement on the ventilator and the period of worsening oxygenation should be determined by changes in FiO_2 only, since changes in PEEP as indicated in this surveillance algorithm may not be applicable to APRV. In addition, patients with VAE who are on APRV or related modes of mechanical ventilation should be indicated as such on the VAE Form (CDC 57.112).

NOTE: VAEs are defined by a 14-day period, starting on the day of onset of worsening oxygenation (the event date, day 1). A new VAE cannot be identified or reported until this 14-day period has elapsed. See FAQ no. 4.

Date of event: The date of onset of worsening oxygenation. This is defined as the first calendar day in which the daily minimum PEEP or FiO_2 increases above the thresholds outlined in the VAE definition algorithm (i.e., day 1 of the required ≥ 2-day period of worsening oxygenation following a ≥ 2-day period of stability or improvement on the ventilator).

EXAMPLE: A patient is intubated in the Emergency Room for severe community-acquired pneumonia and admitted to the MICU (day 1). The patient stabilizes and improves on days 2-5, with a daily minimum FiO_2 of 0.35 (35%) on days 4 and 5. On day 6, the patient experiences respiratory deterioration, and requires a minimum FiO_2 of 0.60 (60%) on days 6 and 7, meeting the criteria for a VAC. The date of the VAC event is day 6.

NOTE: The "date of event" is NOT the date on which all VAE criteria have been met. It is the first day (of a ≥ 2-day period) on which either of the worsening oxygenation thresholds (for PEEP or FiO_2) is met.

VAE Window Period: This is the period of days around the event date (i.e., the day of onset of worsening oxygenation) within which other VAE criteria must be met. It is usually a 5-day period and includes the 2 days before, the day of, and the 2 days after the VAE event date (i.e., the first day of worsening oxygenation, the day of VAE onset). There is an exception, however, in which the VAE Window Period is only 3 or 4 days, as follows:

In cases where the VAE event date corresponds to MV day 3 or day 4, the window period described above may only be a 3-day or a 4-day window, because it can NOT include any days before the 3rd day of MV. For example, if the VAE event date is MV day 3, then the window period includes only the day of VAE onset and the 2 days after VAE onset (because the 2 days before VAE onset are before the 3rd day of MV).

Positive End-Expiratory Pressure (PEEP): "A technique used in respiratory therapy in which airway pressure greater than atmospheric pressure is achieved at the end of exhalation by the introduction of a mechanical impedance to exhalation" [18]. In patients on mechanical ventilation, PEEP is one of the key parameters that can be adjusted depending on the patient's oxygenation needs, and is typically in the range of 0 to 15 cmH_2O. A sustained increase (defined later in this protocol) in the daily minimum PEEP of ≥ 3 cmH_2O following a period of stability or improvement on the ventilator is one of two criteria that can be used in meeting the VAC definition. For the purposes of this surveillance, PEEP values from 0 to 5 cmH_2O are considered equivalent.

Fraction of inspired oxygen (FiO_2): The fraction of oxygen in inspired gas. For example, the FiO_2 of ambient air is 0.21; the oxygen concentration of ambient air is 21%. In patients on mechanical ventilation, the FiO_2 is one of the key parameters that can be adjusted depending on the patient's oxygenation needs, and is typically in the range of 0.30 (oxygen concentration of 30%) to 1.0 (oxygen concentration of 100%). A sustained increase (defined later in this protocol) in the daily minimum FiO_2 of $\geq$ 0.20 (20%) following a period of stability or improvement on the ventilator is the second of the two criteria that can be used in meeting the VAC definition.

Daily minimum PEEP: The lowest value of PEEP during a calendar day that is set on the ventilator and *maintained for at least 1 hour*. This requirement that the daily minimum PEEP be the lowest setting maintained for at least 1 hour will ensure that units monitoring and recording PEEP settings hourly or more frequently than once per hour are able to apply the VAE surveillance PEEP criterion in a standardized way. In the event that ventilator settings are monitored and recorded less frequently than once per hour, the daily minimum PEEP is simply the lowest value of PEEP set on the ventilator during the calendar day. In circumstances where there is no value that is documented to have been maintained for at least one hour (e.g., the lowest value of PEEP is set late in the calendar day, mechanical ventilation is discontinued early in the calendar day, PEEP settings are changed very frequently throughout the calendar day) the daily minimum PEEP should default to the lowest PEEP setting during the calendar day (regardless of how long that setting was maintained). For example, a patient who is intubated and started on mechanical ventilation at 11:30 pm on June 1, with a PEEP setting of 10 cmH_2O from 11:30 pm to midnight, would have a daily minimum PEEP of 10 cmH_2O on June 1 for the purposes of VAE surveillance.

> NOTE: In units tracking PEEP settings every hour or more frequently than every hour, there must be sufficient consecutive recordings of a specific PEEP setting to meet the minimum required duration of 1 hour. For example, in units tracking PEEP every 15 minutes, 5 consecutive recordings of PEEP at a certain level would be needed to meet the required 1 hour minimum duration (e.g., at 09:00, 09:15, 09:30, 09:45 and 10:00). In units tracking PEEP every 30 minutes, 3 consecutive recordings of PEEP at a certain level would be needed to meet the required 1 hour minimum duration (e.g., at 09:00, 09:30, and 10:00). In units tracking PEEP every hour, 2 consecutive recordings of PEEP at a certain level would be needed to meet the required 1 hour minimum duration (e.g., at 09:00 and 10:00).

EXAMPLE: The patient is intubated at 6 pm. PEEP is set at the following values through the remainder of the calendar day:

Time	**6 pm**	**7 pm**	**8 pm**	**9 pm**	**10 pm**	**11 pm**
PEEP (cmH_2O)	10	8	5	5	8	8

In this example, the daily minimum PEEP for the purposes of VAE surveillance is 5 cmH_2O. PEEP settings are being monitored and recorded every hour. There are two consecutive hours where the PEEP setting is noted to be 5 cmH_2O (8 pm and 9 pm), and therefore required minimum duration of 1 hour is met.

EXAMPLE: The patient is intubated at 6 pm. PEEP is set at the following values through the remainder of the calendar day:

Time	**6 pm**	**7 pm**	**8 pm**	**9 pm**	**10 pm**	**11 pm**
PEEP (cmH_2O)	8	8	5	8	5	8

In this example, the daily minimum PEEP for the purposes of VAE surveillance is 8 cmH_2O. PEEP settings are being monitored and recorded every hour. Although the lowest PEEP is 5 cmH_2O, it is recorded at two non-consecutive time points only (8 pm, then 10 pm), and so the required 1 hour minimum duration is not met. There are two consecutive hours where the PEEP setting is noted to be 8 cmH_2O (6 pm and 7 pm), and therefore the required minimum duration of 1 hour is met to allow use of this setting as the daily minimum value for VAE surveillance.

EXAMPLE: PEEP is set at the following values through the course of a calendar day:

Time	**12 am**	**4 am**	**8 am**	**12 pm**	**4 pm**	**8 pm**
PEEP (cmH_2O)	5	8	5	8	8	10

In this example, the daily minimum PEEP is 5 cmH_2O. PEEP settings are being monitored and recorded every 4 hours; therefore the lowest recorded PEEP setting for the calendar day is the value used in VAE surveillance.

EXAMPLE: You are reviewing a patient's ventilator settings on Wednesday morning to determine the daily minimum PEEP values for Monday and Tuesday. The MICU monitors and records PEEP settings for mechanically ventilated patients every 30 minutes. You see that the lowest PEEP setting on Monday (5 cmH_2O) was recorded at 11:30 pm when the episode of mechanical ventilation was initiated for this patient. The patient remained at this PEEP setting for an additional 30 minutes on Tuesday morning, and was then maintained on PEEP 10 cmH_2O for the rest of the day on Tuesday. What do you record as the daily minimum PEEP for Monday and for Tuesday? In this example, the only PEEP setting recorded on Monday was 5 cmH_2O. Because there is no value on Monday that has been maintained for at least one hour, the lowest (and only) setting of 5 cmH_20 is recorded as the daily minimum PEEP for that calendar day. On Tuesday, the daily minimum PEEP should be recorded as 10 cmH_2O, which is the lowest PEEP setting maintained for at least 1 hour on Tuesday.

Day	**Time**	**PEEP (cmH_2O)**
Monday	23:30	5
Tuesday	00:00	5
Tuesday	00:30	5
Tuesday	01:00	10
Tuesday	01:30	10
Tuesday	02:00 through 23:30	10

Daily minimum FiO_2: The lowest value of FiO_2 during a calendar day that is set on the ventilator and *maintained for at least 1 hour*. This requirement that the daily minimum FiO_2 be the lowest setting maintained for at least 1 hour will ensure that units monitoring and recording FiO_2 settings hourly or more frequently than once per hour are able to apply the VAE surveillance FiO_2 criterion in a standardized way. In the event that ventilator settings are monitored and recorded less frequently than once per hour, the daily minimum FiO_2 is simply the lowest value of FiO_2 set on the ventilator during the calendar day. Similarly, in circumstances where there is no value that has been maintained for at least one hour (e.g., the lowest value of FiO_2 is set late in the calendar day, mechanical ventilation is discontinued early in the calendar day) the daily minimum FiO_2 is the lowest value of FiO_2 set on the ventilator during the calendar day.

NOTE: In units tracking FiO_2 settings every hour or more frequently than every hour, there must be sufficient consecutive recordings of a specific FiO_2 setting to meet the minimum required duration of 1 hour. For example, in units tracking FiO_2 every 15 minutes, 5 consecutive recordings of FiO_2 at a certain level would be needed to meet the required 1 hour minimum duration (e.g., 09:00, 09:15, 09:30, 09:45 and 10:00). In units tracking FiO_2 every 30 minutes, 3 consecutive recordings of FiO_2 at a certain level would be needed to meet the required 1 hour minimum duration (e.g., 09:00, 09:30, and 10:00). In units tracking FiO_2 every hour, 2 consecutive recordings of FiO_2 at a certain level would be needed to meet the required 1 hour minimum duration (e.g., 09:00 and 10:00).

EXAMPLE: The patient is intubated at 6 pm. FiO_2 is set at the following values through the remainder of the calendar day:

Time	**6 pm**	**7 pm**	**8 pm**	**9 pm**	**10 pm**	**11 pm**
FiO_2	1.0	0.8	0.5	0.5	0.8	0.8

In this example, the daily minimum FiO_2 for the purposes of VAE surveillance is 0.5. FiO_2 settings are being monitored and recorded every hour. There are two consecutive hours where the FiO_2 setting is noted to be 0.5 (8 pm and 9 pm), and therefore required minimum duration of 1 hour is met.

EXAMPLE: The patient is intubated at 6 pm. FiO_2 is set at the following values through the remainder of the calendar day:

Time	**6 pm**	**7 pm**	**8 pm**	**9 pm**	**10 pm**	**11 pm**
FiO_2	0.8	0.8	0.5	0.8	0.5	0.8

In this example, the daily minimum FiO_2 for the purposes of VAE surveillance is 0.8. FiO_2 settings are being monitored and recorded every hour. Although the lowest FiO_2 is 0.5, it is recorded at two non-consecutive time points only (8 pm, and then 10 pm), and so the required 1 hour minimum duration is not met. There are two consecutive hours where the FiO_2 setting is noted to be 0.8 (6 pm and 7 pm), and therefore the required minimum duration of 1 hour is met to allow use of this setting as the daily minimum value for VAE surveillance.

EXAMPLE: FiO_2 is set at the following values through the course of a calendar day:

Time	**2 pm**	**4 pm**	**6 pm**	**8 pm**	**10 pm**	**12 am**
FiO_2	1.0	0.60	0.40	0.50	0.55	0.60

In this example, the patient was intubated at 2 pm. The daily minimum FiO_2 is 0.40. FiO_2 settings are being monitored and recorded every 2 hours; therefore, the lowest recorded FiO_2 setting for the calendar day is the value used in VAE surveillance.

EXAMPLE: You are reviewing a patient's ventilator settings on Friday morning to determine the daily minimum FiO_2 value for Thursday, the day of mechanical ventilation initiation. The ICU monitors and records FiO_2 settings for mechanically ventilated patients every 15 minutes. Based on the information recorded in the table below, what should you record as the daily minimum FiO_2 for Thursday? In this example, since there is no setting that is maintained for at least 1 hour during the calendar day, the daily minimum FiO_2 for Thursday is 0.50 (50%). This is the lowest value of FiO2 set on the ventilator during the calendar day.

Day	**Time**	**FiO_2**
Thursday	09:00	0.80
	09:15	0.60
	09:30	0.60
	09:45	0.50
	10:00	0.50
	10:15	0.50
	10:30	0.50
	10:45	0.55
	11:00	0.55
	11:15	0.55
	11:30	0.55
	11:45	0.60
	12:00 to 23:45	0.60

Ventilator: A device to assist or control respiration, inclusive of the weaning period, through a tracheostomy or by endotracheal intubation.

NOTE: Lung expansion devices such as intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (nasal PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP).

Episode of mechanical ventilation: Defined as a period of days during which the patient was mechanically ventilated for some portion of each consecutive day.

NOTE: A break in mechanical ventilation of at least one full calendar day, followed by reintubation and/or reinitiation of mechanical ventilation during the same hospitalization, defines a new episode of mechanical ventilation.

EXAMPLE: A patient is intubated and mechanical ventilation is initiated at 11 pm on hospital day 1. The patient remains intubated and mechanically ventilated from hospital days 2-10. The patient is extubated at 9 am on hospital day 11, and remains extubated on hospital day 12. The patient is reintubated and mechanical ventilation is reinitiated on hospital day 13. The patient remains intubated and mechanically ventilated from hospital day 14-18. This patient has had two episodes of mechanical ventilation (days 1-11 and days 13-18), separated by at least one full calendar day off of mechanical ventilation.

New antimicrobial agent: Defined as any agent listed in the Appendix that is initiated on or after the third calendar day of mechanical ventilation AND in the VAE Window Period (i.e., the period typically defined by the 2 calendar days before, the day of, and the 2 calendar days after the onset date of the VAE). The agent is considered new for the purposes of this definition if it was NOT given to the patient on either of the 2 days preceding the current start date.

EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1 in the MSICU. Ceftriaxone and azithromycin are started on day 1 and administered daily. After 3 days of improving respiratory status, the patient's oxygenation deteriorates on days 4 and 5, with a daily minimum PEEP that is 4 cmH_2O higher than it was on days 2 and 3. Criteria for the VAC definition are met; the date of the event is hospital day 4. Ceftriaxone is discontinued and meropenem is begun on day 5. Azithromycin is continued. In this case, meropenem is a new antimicrobial agent: 1) it was begun on day 5 of mechanical ventilation, and 2) within the VAE Window Period (on the day after VAE onset), and 3) it was not given to the patient on either of the 2 days preceding the current start date. By contrast, ceftriaxone and azithromycin would not be considered new antimicrobial agents, since they were begun on day 1 of mechanical ventilation and continued daily into the VAE Window Period.

The antimicrobial agent(s) must have been given by one of the routes of administration outlined in Table 1, and therapy with one or more new antimicrobial agents must be continued for at least 4 calendar days (referred to as 4 "qualifying antimicrobial days" or "QADs"). For further guidance on identification of new antimicrobial agents and on how to determine whether the requirement for 4 QADs is met, refer to FAQs nos. 6-10 at the end of this chapter.

Table 1. Definitions of routes of administration

Route of Administration[a]	**Definition**[b]
Intravenous	An intravascular route that begins with a vein.
Intramuscular	A route that begins within a muscle.
Digestive Tract	A route that begins anywhere in the digestive tract extending from the mouth through rectum.
Respiratory Tract	A route that begins within the respiratory tract, including the oropharynx and nasopharynx.

[a]Other routes of administration are excluded (e.g., antibiotic locks, intraperitoneal, intraventricular, irrigation, topical).
[b]Definitions per SNOMED Reference Terminology

Qualifying Antimicrobial Day (QAD): A day on which the patient was administered an antimicrobial agent that was determined to be "new" within the VAE Window Period. Four consecutive QADs are needed to meet the IVAC antimicrobial criterion—starting within the VAE Window Period. Days on which a new antimicrobial agent is administered count as QADs. Days between administrations of a new antimicrobial agent also count as QADs as long as there is a gap of no more than 1 calendar day between administrations. For example, if levofloxacin is given on VAE Day 1, has not been given in the 2 preceding calendar days, and is given again on VAE Days 3, 5 and 7, there are 7 QADs—because the days between levofloxacin doses also count as QADs. By contrast, days between administrations of different antimicrobial agents do NOT count as QADs; for example, if levofloxacin is given to the patient on VAE Days -2 and -1 only, no antimicrobials are given on VAE Day 1, and meropenem is given only on VAE Day 2 (remember there is no VAE Day 0), then there are not 4 consecutive QADs. VAE Days -2 and -1 count as 2 consecutive QADs, but VAE Day 1 cannot be counted as a QAD because it is a day between different antimicrobial agents.

Purulent Respiratory Secretions: Defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100].

> NOTE: Some clinical laboratories may use different results reporting formats for direct examinations of respiratory secretions. Additional instructions for using the purulent respiratory secretions criterion are provided in Table 2, below.

Table 2. Instructions for using the purulent respiratory secretions criterion, based on laboratory reporting of respiratory secretion direct examination results.

How do I use the purulent respiratory secretions criterion if …	Instruction
My laboratory reports counts of "white blood cells" or "polymorphonuclear leukocytes" or "leukocytes" rather than counts of "neutrophils"?	Assume that counts of cells identified by these other descriptors (e.g., "white blood cells") are equivalent to counts of neutrophils, unless the laboratory tells you this is not the case.
My laboratory reports semi-quantitative results (not quantitative results) for numbers of neutrophils and squamous epithelial cells?	Check with the laboratory to get information about what quantitative ranges the semi-quantitative reports correspond to.
My laboratory cannot provide additional information on how its semi-quantitative reporting corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells?	Use the following direct examination results to meet the purulent respiratory secretions criterion: heavy, 4+, or ≥25 neutrophils per low power field (lpf) [x100], AND rare, occasional, few, 1+ or 2+, or ≤10 squamous epithelial cells per lpf [x100] [19].
My laboratory reports only the numbers of neutrophils present, without reporting the number of squamous epithelial cells?	In this situation, the purulent secretions criterion may be met using the specified quantitative and semi-quantitative thresholds for neutrophils alone (i.e., heavy, 4+, or ≥25 neutrophils per lpf [x100]).
My laboratory uses different reporting thresholds for neutrophils and squamous epithelial cells (e.g., maximum report of ≥ 20 neutrophils per low power field [x100], or minimum report of ≤ 15 squamous epithelial cells per low power field [x100])?	In this situation, the purulent secretions criterion may be met using the laboratory's specified maximum quantitative threshold for neutrophils, and/or minimum quantitative threshold for squamous epithelial cells.
My laboratory processes respiratory specimens such as bronchoalveolar lavage fluid using a centrifugation procedure (e.g., "cytospin"), and there is no quantitation or semi-quantitation of neutrophils or white blood cells in the direct examination report?	In this situation, a report indicating the presence of white blood cells, without quantitation, is sufficient to meet the purulent secretions criterion.

Location of attribution: The inpatient location where the patient was assigned on the date of the VAE, which is further defined as the date of onset of worsening oxygenation.

> EXAMPLE: Patient is intubated and ventilated in the Operating Room on hospital day 1, and then is admitted post-operatively to the SICU on hospital day 1, still on the ventilator. On hospital day 3, the patient experiences the onset of worsening

oxygenation, manifested by an increase in the daily minimum FiO_2 of ≥ 0.20 (20%). On day 4 (also the 4th day of mechanical ventilation) the patient meets criteria for a VAC. This is reported to NHSN as a VAC for the SICU.

EXCEPTION:
Transfer Rule: If a VAE develops on the day of transfer or the day following transfer from one inpatient location to another in the same facility or to a new facility (where the day of transfer is day 1), the event is attributed to the transferring location. This is called the Transfer Rule, and examples are shown below:

EXAMPLE: Patient on a ventilator in the SICU who has had improving oxygenation for 3 days is transferred to the MICU, still on the ventilator. On the day of transfer, after the patient has arrived in the MICU, the patient experiences an acute decompensation, requiring an increase of 0.30 (30 points) in FiO_2 that persists during the following calendar day. VAC criteria are met on calendar day 2 in the MICU. Because the onset of worsening oxygenation occurred on the day of transfer to the MICU, the VAC event is attributed to the SICU.

EXAMPLE: Patient is extubated in the MICU and transferred to the medical stepdown unit on hospital day 6. The next day, while in the stepdown unit (day 7), the patient experiences worsening oxygenation and is reintubated and transferred back to the MICU. Criteria for VAC are met the next day (day 8). In this case, the day prior to extubation and the day of extubation (hospital days 5 and 6) count as the required 2-day period of stability or improvement. The day of reintubation (day 7) and the following day (day 8) count as the required 2-day period of worsening oxygenation. Because the onset of worsening oxygenation occurred on the day following transfer out of the MICU, the event is reported to NHSN as a VAC for the MICU.

EXAMPLE: Patient intubated and mechanically ventilated for 8 days in the MSICU of Hospital A is transferred for further care on day 8 to the MSICU of Hospital B. The patient was stable on the ventilator in Hospital A from days 3-8. On the day of transfer to Hospital B (day 1 in Hospital B), the patient's respiratory status deteriorates. The day after transfer (day 2 in Hospital B), the patient meets criteria for VAC. The date of the event is day 1 in Hospital B, the first day of the period of worsening oxygenation meeting VAE PEEP or FiO_2 thresholds. The infection preventionist (IP) from Hospital B calls the Hospital A IP to report that this patient was admitted to Hospital B with a VAC. This VAC should be reported to NHSN for and by Hospital A, and attributed to the Hospital A MSICU. No additional ventilator days are reported by Hospital A.

REPORTING INSTRUCTIONS (additional guidance may be found in the FAQs at the end of this chapter):

- Conducting in-plan VAE surveillance means assessing patients for the presence of ALL events included in the algorithm—from VAC to IVAC to PVAP. At this time, a unit conducting in-plan VAE surveillance cannot decide, for example, that only surveillance for VAC (and not for IVAC or PVAP) will be performed.
- There is a hierarchy of definitions within VAE:
  - If a patient meets criteria for VAC and IVAC, report as IVAC.
  - If a patient meets criteria for VAC, IVAC and PVAP, report PVAP.
- Pathogens are not reported for VAC or IVAC events.
- Secondary BSIs are not reported for VAC or IVAC events (refer to VAE Additional FAQ document for guidance).
- Pathogens may be reported for PVAP events, provided they are isolated or identified from appropriate specimen types according to the requirements of the algorithm and are NOT on the list of excluded organisms and culture results:
  - Excluded organisms and culture results that cannot be used to meet the PVAP definition are as follows: "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract; *Candida* species or yeast not otherwise specified; coagulase-negative *Staphylococcus* species; and *Enterococcus* species, when isolated from cultures of sputum, endotracheal aspirates, bronchoalveolar lavage, or protected specimen brushings. These organisms can be reported as PVAP pathogens if isolated from cultures of lung tissue or pleural fluid.
  - Additionally, because organisms belonging to the following genera are typically causes of community-associated respiratory infections and are rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet the PVAP definition when isolated from any eligible specimen type (to include lung and pleural fluid): *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.*
- There are three criteria that can be used to meet the PVAP definition (Figure 4):
  - Criterion 1: Positive culture meeting specific quantitative or semi-quantitative threshold (Table 3);
  - Criterion 2: Purulent respiratory secretions AND a positive culture NOT meeting the quantitative or semi-quantitative thresholds specified in Table 3;
  - Criterion 3: Positive pleural fluid culture, positive lung histopathology, positive diagnostic test for *Legionella* species or selected respiratory viruses.
- See Table 3 for the required quantitative culture thresholds meeting the PVAP definition. Note that if your laboratory reports semi-quantitative culture results, you should check with your laboratory to confirm that semi-quantitative results match the quantitative thresholds noted in Table 3.

Table 3. Threshold values for cultured specimens used in the PVAP definition

Specimen collection/technique	Values
Lung tissue	$\geq 10^4$ cfu/g tissue*
Bronchoscopically (B) obtained specimens	
Bronchoalveolar lavage (B-BAL)	$\geq 10^4$ cfu/ml*
Protected BAL (B-PBAL)	$\geq 10^4$ cfu/ml*
Protected specimen brushing (B-PSB)	$\geq 10^3$ cfu/ml*
Nonbronchoscopically (NB) obtained (blind) specimens	
NB-BAL	$> 10^4$ cfu/ml*
NB-PSB	$\geq 10^3$ cfu/ml*
Endotracheal aspirate (ETA)	$\geq 10^5$ cfu/ml*

cfu = colony forming units, g = gram, ml = milliliter
*Or corresponding semi-quantitative result.

- Secondary BSIs may be reported for PVAP events, provided that at least one organism isolated from the blood culture matches an organism isolated from an appropriate respiratory tract specimen (including respiratory secretions, pleural fluid and lung tissue). The respiratory tract specimen must have been collected on or after the 3rd day of mechanical ventilation and within 2 calendar days before or after the day of onset of worsening oxygenation to be considered as a criterion for meeting the PVAP definition. In addition, the positive blood culture must have been collected during the 14-day event period, where day 1 is the day of onset of worsening oxygenation (refer to VAE Additional FAQ document for guidance).
  - In cases where PVAP is met with only the histopathology criterion and no culture is performed, and there is also a positive blood culture, a secondary BSI is not reported.
  - In cases where a culture of respiratory secretions, pleural fluid or lung tissue is performed and does not grow an organism that matches an organism isolated from blood, a secondary BSI is not reported.

    NOTE: *Candida* species or yeast not otherwise specified, coagulase-negative *Staphylococcus* species, and *Enterococcus* species cultured from blood cannot be deemed secondary to a PVAP, unless the organism was also cultured from pleural fluid or lung tissue.

Figure 1: Ventilator-Associated Events (VAE) Surveillance Algorithm

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1) Increase in daily minimum* FiO_2 of ≥ 0.20 (20 points) over the daily minimum FiO_2 in the baseline period, sustained for ≥ 2 calendar days.
2) Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP in the baseline period†, sustained for ≥ 2 calendar days.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

†Daily minimum PEEP values of 0-5 cmH_2O are considered equivalent for the purposes of VAE surveillance.

Ventilator-Associated Condition (VAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature > 38 °C or < 36°C, **OR** white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3.
AND
2) A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started, and is continued for ≥ 4 calendar days.

Infection-related Ventilator-Associated Complication (IVAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (**taking into account organism exclusions specified in the protocol**):

1) Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, ≥ 10^5 CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, ≥ 10^4 CFU/ml or corresponding semi-quantitative result
   - Lung tissue, ≥ 10^4 CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, ≥ 10^3 CFU/ml or corresponding semi-quantitative result
2) Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100])† plus a positive culture of one of the following specimens (qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):
   - Sputum
   - Endotracheal aspirate
   - Bronchoalveolar lavage
   - Lung tissue
   - Protected specimen brush

   † If the laboratory reports semi-quantitative results, those results must correspond to the above quantitative thresholds. See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol.
3) Criterion 3: One of the following positive tests:
   - Pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
   - Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
   - Diagnostic test for *Legionella* species
   - Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

Possible Ventilator-Associated Pneumonia (PVAP)

Figure 2: Ventilator-Associated Condition (VAC)

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

AND

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1) Increase in daily minimum* FiO_2 of ≥ 0.20 (20 points) over the daily minimum FiO_2 in the baseline period, sustained for ≥ 2 calendar days.

2) Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP in the baseline period†, sustained for ≥ 2 calendar days.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for at least 1 hour.

†Daily minimum PEEP values of 0-5 cmH_2O are considered equivalent for the purposes of VAE surveillance.

Figure 3: Infection-related Ventilator-Associated Complication (IVAC)

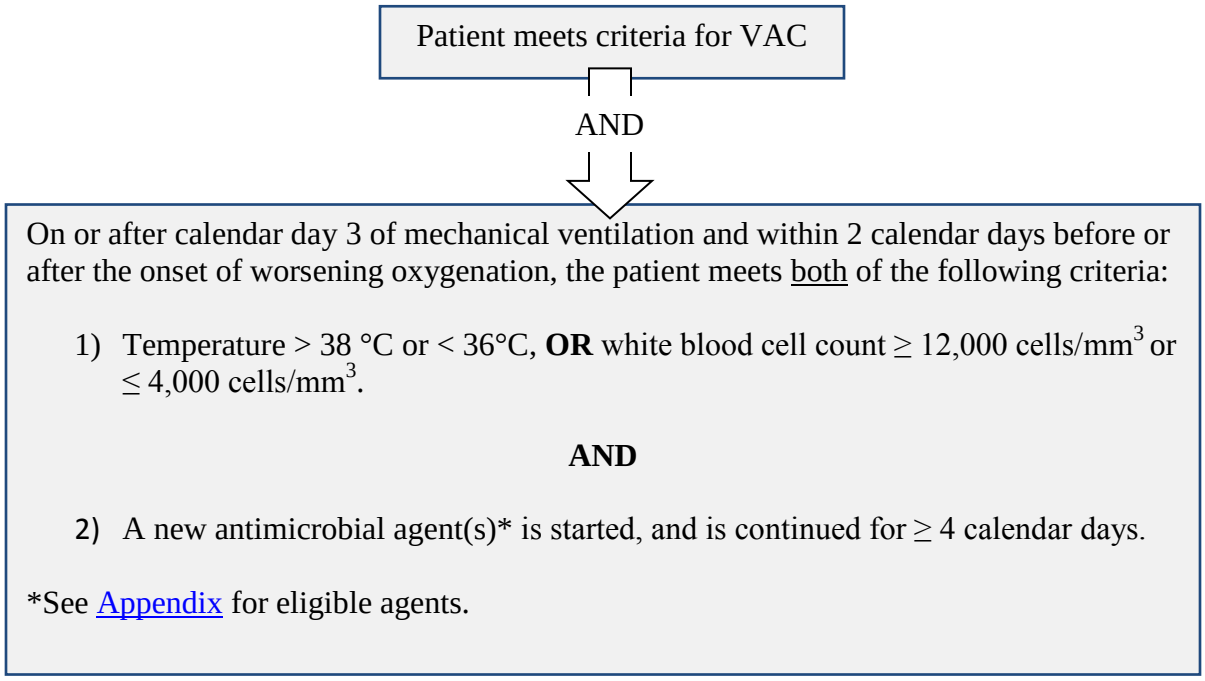

Figure 4: Possible Ventilator-Associated Pneumonia (PVAP)

Patient meets criteria for VAC and IVAC

AND

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (taking into account organism exclusions specified in the protocol*):

1) Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, $\geq 10^5$ CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, $\geq 10^4$ CFU/ml or corresponding semi-quantitative result
   - Lung tissue, $\geq 10^4$ CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, $\geq 10^3$ CFU/ml or corresponding semi-quantitative result
2) Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100])† plus a positive culture of one of the following specimens (qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):
   - Sputum
   - Endotracheal aspirate
   - Bronchoalveolar lavage
   - Lung tissue
   - Protected specimen brush

   † If the laboratory reports semi-quantitative results, those results must correspond to the quantitative thresholds. See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol.
3) Criterion 3: One of the following positive tests:
   - Pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
   - Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
   - Diagnostic test for *Legionella* species
   - Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

**Excludes the following:* Normal respiratory/oral flora, mixed respiratory/oral flora or equivalent*; Candida* species or yeast not otherwise specified; coagulase-negative *Staphylococcus* species*; Enterococcus* species. Also excludes the following community-associated respiratory pathogens: *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.*

Numerator Data: The *Ventilator-Associated Event* form (CDC 57.112) is used to collect and report each VAE that is identified during the month selected for surveillance. The Instructions for Completion of Ventilator-Associated Event Form includes brief instructions for collection and entry of each data element on the form. The VAE form includes patient demographic information and information on the start date and location of initiation of mechanical ventilation. Additional data include the specific criteria met for identifying VAE, whether the patient developed a secondary bloodstream infection, whether the patient died, and, where applicable, the organisms detected and their antimicrobial susceptibilities.

REPORTING INSTRUCTION:

- If no VAEs are identified during the month of surveillance, the Report No Events box must be checked on the appropriate denominator summary screen, e.g., Denominators for Intensive Care Unit (ICU)/other locations (Not NICU or SCA), etc.

Denominator Data: Device days and patient days are used for denominators (see Chapter 16 Key Terms). Ventilator days, which are the numbers of patients managed with ventilatory devices, are collected daily, at the same time each day, according to the chosen location using the appropriate form (CDC 57.117 and 57.118). These daily counts are summed and only the total for the month is entered into NHSN. Ventilator and patient days are collected for each of the locations monitored. When denominator data are available from electronic sources (e.g., ventilator days from respiratory therapy), these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected counts, pre-validated for a minimum of 3 months.

Collection of an additional denominator, episodes of mechanical ventilation (EMV), is optionally available for VAE surveillance beginning in January 2015. A patient may have more than one episode of ventilation occur during a month. The EMV denominator represents the sum of the number of episodes of mechanical ventilation that occurred during the month. This is determined by counting all patients that are on mechanical ventilation on the first day of the month and counting each additional new patient that is started on ventilation on every subsequent day of the month to include new episodes identified in previously ventilated patients. The sum of the count for the first day and each subsequent day of the month is entered in NHSN.

EXAMPLE: On January 1, there are 5 patients on mechanical ventilation in the MICU (2 patients were started on mechanical ventilation on December 24, 2 patients on December 31, and 1 patient on January 1). During the rest of the month, the following are noted: 1 patient is started on mechanical ventilation on January 8; 2 patients are transferred to the MICU on mechanical ventilation on January 15, and 1 patient who was previously ventilated (from January 1 through January 12) goes back on mechanical ventilation on January 20. No other patients are on mechanical ventilation during the month of January. The number of EMV for January is nine. This is calculated as follows: 5 patients(on mechanical ventilation on the first day of the month) + 4 patients who were either started on mechanical ventilation, transferred into the MICU on

mechanical ventilation, or re-initiated on mechanical ventilation after being off of the vent for at least 1 calendar day = 9 EMV.

NOTE: All ventilator days are counted, including ventilator days for patients on mechanical ventilation for < 3 days, and patients on high frequency ventilation and other therapies excluded from VAE surveillance. Patients with tracheostomies who are undergoing weaning from mechanical ventilation using tracheostomy collar trials are included in ventilator day counts as long as they spend some portion of the day on mechanical ventilation at a time that overlaps with the daily time during which ventilator day counts are performed.

NOTE: In addition to the total number of patients on ventilators on each day of surveillance, the number of patients on ventilators who are on the APRV mode of mechanical ventilation or related modes (which is a subset of all patients on ventilators) should also be indicated on the appropriate form (CDC 57.117 and 57.118). See FAQ nos. 22 and 23.

Data Analyses: The VAE rate per 1000 ventilator days is calculated by dividing the number of VAEs by the number of ventilator days and multiplying the result by 1000 (ventilator days). The rate per 100 episodes of mechanical ventilation is calculated by dividing the number of VAEs by the number of episodes of mechanical ventilation and multiplying the result by 100 (episodes of mechanical ventilation). Rates that may be appropriate for use in public reporting, inter-facility comparisons, and pay-for-reporting/pay-for-performance programs are the overall VAE rate (where the numerator consists of all events meeting at least the VAC definition) and the "IVAC-plus" rate (where the numerator consists of all events meeting at least the IVAC definition). Rates that may be appropriate for internal use within an individual unit or facility include rates of specific event types (e.g., events meeting only the VAC definition, events meeting only the IVAC definition, events meeting only the PVAP definition),. The Ventilator Utilization Ratio is calculated by dividing the number of ventilator days by the number of patient days. These calculations will be performed separately for the different types of ICUs, SCAs, and other locations in the institution.

****The information that follows regarding the Standardized Infection Ratio (SIR) is for informational purposes only, until a baseline period of VAE reporting has been established.****

The Standardized Infection Ratio (SIR) is calculated by dividing the number of observed events by the number of expected (or predicted) events. The number of predicted events, in the context of statistical prediction, is calculated using VAE rates from a standard population during a baseline time period as reported in the NHSN Report.

NOTE: The SIR should be calculated only if the number of predicted VAEs is ≥ 1.

SIR = Observed (O) VAEs / Expected (E) VAEs

While the VAE SIR can be calculated for single locations, the measure also allows you to summarize your data by multiple locations, adjusting for differences in the incidence of VAEs among the location types. For example, you can calculate one VAE SIR adjusting for all locations reported. Similarly, you can calculate one VAE SIR for all specialty care areas in your facility.

Descriptive analysis options of numerator and denominator data are available in the NHSN application, such as line listings, frequency tables, and bar and pie charts. VAE rates and run charts are also available. Guides on using NHSN analysis features are available from: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

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Appendix. List of Antimicrobials Agents Eligible for IVAC, PVAP

Antimicrobial Agent
AMIKACIN
AMPHOTERICIN B
AMPHOTERICIN B LIPOSOMAL
AMPICILLIN
AMPICILLIN/SULBACTAM
ANIDULAFUNGIN
AZITHROMYCIN
AZTREONAM
CASPOFUNGIN
CEFAZOLIN
CEFEPIME
CEFOTAXIME
CEFOTETAN
CEFOXITIN
CEFTAROLINE
CEFTAZIDIME
CEFTIZOXIME
CEFTRIAXONE
CEFUROXIME
CIPROFLOXACIN
CLARITHROMYCIN
CLINDAMYCIN
COLISTIMETHATE
DORIPENEM
DOXYCYCLINE
ERTAPENEM
FLUCONAZOLE
FOSFOMYCIN
GEMIFLOXACIN
GENTAMICIN
IMIPENEM/CILASTATIN
ITRACONAZOLE

LEVOFLOXACIN
LINEZOLID
MEROPENEM
METRONIDAZOLE
MICAFUNGIN
MINOCYCLINE
MOXIFLOXACIN
NAFCILLIN
OSELTAMIVIR
OXACILLIN
PENICILLIN G
PIPERACILLIN
PIPERACILLIN/TAZOBACTAM
POLYMYXIN B
POSACONAZOLE
QUINUPRISTIN/DALFOPRISTIN
RIFAMPIN
SULFAMETHOXAZOLE/TRIMETHOPRIM
SULFISOXAZOLE
TEDIZOLID
TELAVANCIN
TELITHROMYCIN
TETRACYCLINE
TICARCILLIN/CLAVULANATE
TIGECYCLINE
TOBRAMYCIN
VANCOMYIN, intravenous only
VORICONAZOLE
ZANAMIVIR

VAE FREQUENTLY-ASKED QUESTIONS

1) When should I use VAE? Are there circumstances in which I should still use PNEU?

- VAE surveillance is location based, and restricted to adult inpatient units only.
- Pediatric and neonatal units are excluded from VAE surveillance (even in circumstances where a pediatric unit may occasionally care for patients who are 18 years of age and older).
- Locations mapped to mixed age CDC location codes are excluded from VAE surveillance.
- Ventilated patients who are 18 years of age and older and who are cared for in pediatric units should be included in any in-plan PedVAP surveillance for that location.

NOTE: it is NOT recommended to include in VAE surveillance young children housed in adult ICU locations who are not thought to be physiologically similar to the location's adult patient population. Facilities may want to evaluate their location mapping to be sure that locations are mapped appropriately to the correct CDC location codes. In circumstances where the populations of adults and children cared for in the same physical location is more mixed (e.g., 50% adult patients and 50% pediatric patients), it is recommended that facilities weigh the possibility of establishing a virtual pediatric location for the purposes of surveillance. More information on virtual locations and location mapping can be found here: http://www.cdc.gov/nhsn/PDFs/pscManual/15LocationsDescriptions_current.pdf

- While on high frequency ventilation or extracorporeal life support, patients are EXCLUDED from VAE surveillance.

  NOTE: Patients who are receiving a conventional mode of mechanical ventilation while in the prone position and patients who are receiving a conventional mode of mechanical ventilation while receiving nitric oxide therapy, helium-oxygen mixtures (heliox), or epoprostenol therapy are INCLUDED.

  NOTE: Patients on Airway Pressure Release Ventilation (APRV) and related modes of mechanical ventilation (see FAQ nos. 22 and 23) are INCLUDED; however, during periods of time while the patient is on APRV, the VAE period of stability or improvement on the ventilator and the period of worsening oxygenation should be determined by changes in FiO_2 only, since changes in PEEP as indicated in this surveillance algorithm may not be applicable to APRV. In addition, patients with VAE who are on APRV or a related mode of mechanical ventilation at the time of VAE onset should be indicated as such on the VAE Form (CDC 57.112).

- In-plan surveillance for ventilator-associated PNEU may still be conducted for pediatric patients ONLY ("PedVAP" surveillance).
- The PNEU definitions are still available for those units seeking to conduct off-plan PNEU/VAP surveillance for patients of any age.

2) I am having difficulty visualizing how to arrange the VAE data elements to facilitate easy identification of events. Can you provide some additional guidance?

- For units in which VAE surveillance will be conducted manually, we recommend that you organize the necessary data elements in a table or spreadsheet to assist in identifying VAEs. There are a number of different ways in which to organize the data – you may consider limiting your spreadsheet to just include the daily minimum PEEP and FiO_2 values, and then, if a VAC event is identified, utilize other data sources to gather information on the data elements included in the IVAC and PVAP definitions. Alternatively, you may choose to include columns for all data elements (from VAC through PVAP) in a single spreadsheet.

  NOTE: For most patients under surveillance for VAE, the only data elements you will need to record are the ventilator days, minimum daily PEEP, and minimum daily FiO_2. The maximum and minimum daily temperatures and white blood cell counts only need to be recorded for those patients who are identified as having met criteria for VAC. The antimicrobial criterion only needs to be assessed for those patients with VAC and with an abnormal temperature or white blood cell count that meets the criteria within the IVAC definition. Microbiology and related data elements included as criteria in the PVAP definition only need to be assessed for those patients who have met the IVAC definition.

  NOTE: Keep in mind that the baseline period of stability or improvement on the ventilator is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2, and must be characterized by ≥ 2 calendar days of stable or decreasing daily minimum FiO_2 or PEEP values (i.e., the daily minimum PEEP or FiO_2 on the second day of the baseline period of stability or improvement must be equal to or less than the daily minimum PEEP or FiO_2 on the first day of the baseline period of stability or improvement). Keep in mind, too, that PEEP values of 0 to 5 cmH_2O are considered equivalent for the purposes of VAE surveillance. This means that any daily minimum value of 0 to 5 cmH_2O will be evaluated as if it were 5 cmH_2O when determining whether a VAC has occurred or not. Also, the daily minimum PEEP or FiO2 is defined as the lowest setting during a calendar day that is maintained for at least 1 hour.

  EXAMPLE: In the table below, the data elements used to meet VAC, IVAC and PVAP definition are organized in a fashion that facilitates identification of an event, highlighted in the shaded region. In this example, MV days 3 and 4 constitute the baseline period, with stable minimum PEEP of 5 cmH_2O on each day. On MV days 5 and 6, the daily minimum PEEP is 8 cmH_2O, which meets the VAC criterion for worsening oxygenation. If we scan across the table, we can see that the IVAC temperature/white blood cell count criterion is not met (there are no temperatures < 36°C or > 38°C, and no white blood cell counts ≤ 4,000 cells/mm^3 or ≥ 12,000 cells/mm^3) – so even though the patient was started on a new antimicrobial agent and

continued on that agent for 4 calendar days, IVAC is not met. Therefore, this event would be reported as a VAC, with the date of event being MV day 5.

Patient	MV Day	$PEEP_{min}$	FiO_{2min}	$Temp_{min}$	$Temp_{max}$	WBC_{min}	WBC_{max}	Abx	Specimen	Polys / Epis	Organism	VAE
1	1	10	1.0	37.1	37.6	4.3	4.3	None	--	--	--	--
1	2	5	0.60	36.8	37.2	4.6	4.6	None	--	--	--	--
1	3	5	0.40	37.0	37.9	5.4	5.4	None	--	--	--	--
1	4	5	0.40	36.5	37.3	9.2	9.2	Yes	--	--	--	--
1	5	8	0.50	36.3	36.9	8.4	8.4	Yes	ETA	≥ 25 / ≤ 10	*S.aureus*	**VAC**
1	6	8	0.40	37.2	37.5	8.5	8.8	Yes	--	--	--	
1	7	5	0.40	37.8	37.9	7.6	7.6	Yes	--	--	--	

MV = mechanical ventilation. $PEEP_{min}$ = Daily minimum PEEP. FiO_{2min} = Daily minimum FiO_2. $Temp_{min}$ = Daily minimum temperature. $Temp_{max}$ = Daily maximum temperature. WBC_{min} = Daily minimum white blood cell count. WBC_{max} = Daily maximum white blood cell count. Abx = antimicrobial agents. Polys / epis = Polymorphonuclear leukocytes and squamous epithelial cells from respiratory specimen.

EXAMPLE: In the table below, by scanning across the data elements, you can see that there are no periods in which there is a stable, 2-day baseline period followed by a 2-day period where the PEEP or FiO_2 are increased 3 cmH_2O or 20 points over baseline. On MV days 2 and 3, the PEEP values are 7 cmH_2O and 6 cmH_2O respectively, and then increase to 9 cmH_2O on MV days 4 and 5 – but the difference between day 4 or day 5 and day 2 is only 2 cmH_2O, rather than the required 3 cmH_2O. Also, the gradual increase in FiO_2 from the time of initiation of mechanical ventilation means that there are not two days on which the FiO_2 is at least 20 points higher than on the 2 previous days. Therefore, although the temperature and white blood cell counts exceed the required thresholds for IVAC on several occasions, and the patient appears to have received a new antimicrobial agent for several days in the setting of a positive blood culture, the VAC definition is not met, and so no VAE is reported.

Patient	MV Day	$PEEP_{min}$	FiO_{2min}	$Temp_{min}$	$Temp_{max}$	WBC_{min}	WBC_{max}	Abx	Specimen	Polys / Epis	Organism	VAE
2	1	5	0.30	37.1	37.6	4.3	4.3	None	--	--	--	--
2	2	7	0.30	36.8	37.2	4.6	4.6	None	--	--	--	--
2	3	6	0.45	37.0	37.9	5.4	5.4	None	--	--	--	--
2	4	9	0.45	36.5	37.3	9.2	9.2	None	--	--	--	--
2	5	9	0.60	36.3	36.9	8.4	8.4	None	ETA	≥ 25 / ≤ 10	*S.aureus*	--
2	6	8	0.60	37.2	37.5	8.5	8.8	None	--	--	--	--
2	7	6	0.75	37.8	37.9	7.6	7.6	None	--	--	--	--
2	8	6	0.75	38.2	38.4	10.5	11.9	Yes	Blood	--	*S. aureus*	--
2	9	5	0.80	38.5	38.9	12.7	12.7	Yes	--	--	--	--
2	10	5	0.75	37.4	38.1	12.9	12.9	Yes	--	--	--	--
2	11	5	0.70	37.2	37.9	9.4	9.4	Yes	--	--	--	--
2	12	5	0.60	37.3	37.5	9.5	9.5	Yes	--	--	--	--
2	13	7	0.60	37.2	37.8	8.2	8.2	Yes	--	--	--	--
2	14	8	0.60	37.0	37.7	8.6	8.6	Yes	--	--	--	--

3) Is there a hierarchy of reporting for VAE? How do I know whether to report a VAC, an IVAC or a PVAP?
   - Conducting in-plan VAE surveillance means assessing patients for the presence of ALL events included in the algorithm—from VAC to IVAC to PVAP. At this time, a unit participating in in-plan VAE surveillance cannot decide, for example, that only surveillance for VAC (and not for IVAC or PVAP) will be performed.
   - There is a hierarchy of definitions within VAE:
     - If a patient meets criteria for VAC and IVAC, report as IVAC.
     - If a patient meets criteria for VAC, IVAC and PVAP, report PVAP.

4) How do I determine the duration of a VAE? Can a patient have more than one VAE during a hospitalization?
   - Patients may have multiple VAEs during a single hospitalization. The event period is defined by the 14-day period that starts on the date of onset of worsening oxygenation. VAE criteria met during that 14-day period are attributed to the current VAE.

     EXAMPLE: Patient is intubated and mechanical ventilation is initiated in the MICU (day 1). The patient is stable during the following 4 calendar days (days 2 through 5). On days 6 and 7 the patient's minimum daily FiO_2 is increased more than 0.20 (20 points) over baseline, therefore meeting the VAC FiO_2 threshold. The VAC episode is defined by the period encompassing days 6 through 19 (14 days, starting on day 1 of worsening oxygenation, which in this case is day 6). If the patient were to experience a period of stability or improvement on the ventilator on days 18 and 19, followed by another 2-day period of worsening on days 20 and 21, a new VAE would be reported, since the second period of worsening oxygenation has occurred more than 14 days after the start of the initial period of worsening oxygenation.

5) Sometimes patients are intubated, extubated, and reintubated several times during a single hospitalization. How do I define an episode of mechanical ventilation, and can a VAE occur in a patient who has recently been extubated?
   - An episode of mechanical ventilation is defined as a period of days during which the patient was mechanically ventilated for some portion of each consecutive day during the period.

     EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1. The patient remains on mechanical ventilation from hospital day 2 through 12 noon on hospital day 6. At noon on hospital day 6, the patient is extubated. The patient remains extubated on hospital day 7, and is then reintubated on hospital day 8. In this case, the first episode of mechanical ventilation is defined by days 1 through 6. Since the patient was extubated on day 6 and remained extubated for a full calendar day on day 7, the re-intubation of the patient on day 8 defines the start of a second episode of mechanical ventilation. See figure, below.

Hosp Day No.	1	2	3	4	5	6	7	8	9	10
MV Episode	1	1	1	1	1	1	--	2	2	2
MV Day No.	1	2	3	4	5	6—extubated at noon	--	1--reintubated	2	3

1 full calendar day off mechanical ventilation, followed by reintubation, defines a new episode of mechanical ventilation.

EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1. The patient remains on mechanical ventilation from hospital day 2 through hospital day 6 at 12 noon. At noon on hospital day 6, the patient is extubated. The patient is reintubated at 9 pm on hospital day 7, and remains intubated and mechanically ventilated till 2 pm on day 10. The patient is extubated at 2 pm on day 10 and remains extubated until hospital discharge on day 15. In this case, there is only a single episode of mechanical ventilation, defined by days 1 through 10, because the patient was extubated on day 6 but reintubated the next calendar day (day 7). See figure, below.

Hosp Day No.	1	2	3	4	5	6	7	8	9	10
MV Episode	1	1	1	1	1	1	1	1	1	1
MV Day No.	1	2	3	4	5	6—extubated at noon	7—reintubated at 9 pm	8	9	10—extubated at 2 pm

Patient was reintubated on the calendar day following extubation (days 6-7). Because there is not 1 calendar day off mechanical ventilation, there is only 1 episode of mechanical ventilation.

- A VAE can occur in a patient who has been extubated and is then reintubated, subject to the amount of time the patient was off the ventilator, as noted in the examples below.

  EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1. The patient remains on mechanical ventilation from hospital day 2 through 12 noon on hospital day 6. At noon on hospital day 6, the patient is extubated. The patient remains extubated on hospital day 7, and is then reintubated on hospital day 8. In this case, because the patient has been extubated for 1 full calendar day (day 7), the "VAE clock" starts over with reintubation on hospital day 8. To meet VAE during this second episode of mechanical ventilation, the patient would have to have at least 2 days of stability or improvement and at least 2 days of worsening oxygenation on the ventilator; therefore, the earliest date on which the patient could meet VAE criteria would be hospital day 11 (stable or improving settings on days 8 and 9, increased ventilator settings on days 10 and 11). The VAE event date would be reported as day 10—the first day of worsening oxygenation meeting VAE criteria. See figure, below.

Hosp Day No.	1	2	3	4	5	6	7	8	9	10	11
MV Episode	1	1	1	1	1	1	--	2	2	2	2
MV Day No.	1	2	3	4	5	6—extubated at noon	--	1--reintubated	2	3	4
VAE Criterion	--	--	--	--	--	--	--	Day 1 of stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation

EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1. The patient remains on mechanical ventilation from hospital day 2 through 12 noon on hospital day 6, when the patient is extubated. The patient is reintubated at 9 pm on hospital day 7. In this case, there is no "new" episode of mechanical ventilation, since there was not a full, ventilator-free calendar day. Therefore, the period of worsening oxygenation may be determined to have started on day 7, the day of reintubation, as long as PEEP or FiO_2 criteria are met. PEEP and FiO_2 data from hospital days 5 and 6 (through the time of extubation) may be used to determine whether a period of stability and improvement occurred, and these data may be compared to PEEP and FiO_2 data obtained from the time of reintubation on day 7 and beyond to determine whether at least 2 days of worsening oxygenation occurred. The earliest that the patient could meet VAE criteria would be day 8 (assuming stable or improving ventilator settings on days 5 and 6, and two days of worsening oxygenation meeting criteria on days 7 and 8). The VAE event date would be reported as day 7—the first day of worsening oxygenation meeting VAE criteria. See figure, below.

Hosp Day No.	1	2	3	4	5	6	7	8	9	10
MV Episode	1	1	1	1	1	1	1	1	1	1
MV Day No.	1	2	3	4	5	6—extubated at noon	7—reintubated at 9 pm	8	9	10
VAE Criterion					Day 1 of stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		

- A patient may also meet criteria for VAC while intubated, and then meet criteria for IVAC (or PVAP) following extubation.

  EXAMPLE: A patient is intubated and mechanically ventilated on hospital day 1. The patient remains on mechanical ventilation till 11 am on hospital day 10, when the patient is extubated. Criteria for VAC are met during the episode of mechanical ventilation, based on 2 days of stability or improvement (MV days 5 and 6) followed by 2 days of worsening oxygenation (MV days 7 and 8). The date of the event is MV day 7, the day of onset of worsening oxygenation. Within the 2 days before and 2 days after the day of onset of worsening oxygenation, the patient has a temperature of 38.4°C, and a new antimicrobial agent is started (meropenem, on MV day 9—see FAQ no. 6-10). The new antimicrobial agent is continued for at least 4 days (hospital days 8 through 11). Therefore, even though the patient was extubated on hospital day 10 and remained extubated on hospital day 11 (the day on which all IVAC criteria were fulfilled), the event should be reported as an IVAC. See figure, below.

Hosp Day No.	4	5	6	7	8	9	10	11
MV Day No.	**4**	**5**	**6**	**7**	**8**	**9**	**Extubated at 11 am**	**--**
VAE Criterion	--	Day 1 of stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation	Temp 38.4°C	--	--
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	**Ceftriaxone**	**Meropenem**	**Meropenem**	**Meropenem**	**Meropenem**

Patient has fulfilled all IVAC criteria, and IVAC should be reported. Date of the IVAC event is hospital day/MV day 7.

6) What antimicrobial agents are included in the IVAC definition?
   - See the Appendix for a list of the antimicrobial agents eligible for consideration in the IVAC definition (as well as the PVAP definition).
   - See Table 1 for eligible routes of administration.

7) How do I figure out if an antimicrobial agent is "new" for the IVAC definition?
   - A new antimicrobial agent is defined as any agent listed in the Appendix that is initiated on or after 3 days of mechanical ventilation AND in the VAE Window Period (defined by the two days before, the day of, and the two days after the onset date of the VAE—as long as all of these days are on or after the 3rd day of mechanical ventilation). The agent is considered new for the purposes of this definition if it was NOT given to the patient on either of the 2 days preceding the current start date. The agent must be administered via one of the routes listed in Table 1. See the example in the figure below:

MV Day No.	4	5	6	7	8	9	10	11
VAE Criterion				Onset (day 1) of worsening oxygenation meeting VAE PEEP or FiO_2 thresholds	Day 2 of worsening oxygenation meeting VAE PEEP or FiO_2 thresholds			

Example of the 5-day period during which the first dose of a new antimicrobial agent must be given to meet requirements of IVAC definition

EXAMPLE: A single dose of intravenous vancomycin is given to a patient on the VAE onset date (which is the day of onset of worsening oxygenation meeting VAE criteria, in this case MV day 7), and was not given to the patient during the 2 previous days (MV days 5 and 6). Vancomycin is therefore considered a new antimicrobial agent (see figure below).

MV Day No.	**4**	**5**	**6**	**7**	**8**	**9**	**10**
VAE Criterion	--	Day 1 of stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent	None	None	None	**Single dose of vancomycin ordered and administered**	**None**	**None**	**Single dose of vancomycin ordered and administered**

A single dose of vancomycin is ordered and administered to the patient within the period defined by the two days before, the day of, and the two days after the VAE onset date. Note that no vancomycin was given in the 2 preceding days, and so vancomycin is a "new" antimicrobial agent for the purposes of the VAE definition.

EXAMPLE: If meropenem is given to a patient on the VAE onset date (which is the day of onset of worsening oxygenation meeting VAE criteria, in this case MV day 7), and was not given to the patient during the 2 previous days (MV days 5 and 6), then meropenem is considered a new antimicrobial agent (see figure below). Note that the patient is also receiving ceftriaxone, and receives doses during the 5-day period around the onset of worsening oxygenation (first dose during the 5-day period was on MV day 5). However, because ceftriaxone was given to the patient the day before the 5-day period (on MV day 4), ceftriaxone does <u>not</u> count as a new antimicrobial agent for the purposes of the IVAC definition.

MV Day No.	**4**	**5**	**6**	**7**	**8**	**9**	**10**
VAE Criterion	--	Day 1 of stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	**Meropenem**	**Meropenem**	**Meropenem**	**Meropenem**

First dose of meropenem during the 5-day period around the onset of worsening oxygenation. Note that no meropenem was given in the 2 preceding days, and so meropenem is a "new" antimicrobial agent for the purposes of the VAE definition.

8) I have figured out that a new antimicrobial agent was given to the patient. How do I determine whether it was continued for 4 days?
   - Make sure you are using the Medication Administration Record. You need to know which antimicrobial agents were actually administered to the patient. Antimicrobial orders or dispensing information is not sufficient.
   - You do not need to know the dose or frequency of administration.
   - Four consecutive Qualifying Antimicrobial Days (QADs)—starting within the VAE Window Period—are needed to meet the IVAC criterion. A QAD is a day on which the patient was administered an antimicrobial agent that was determined to be "new" within the VAE Window Period. Days between administrations of a new antimicrobial agent also count as QADs as long as there is a gap of no more than 1 calendar day between administrations of the same antimicrobial agent. For example, if levofloxacin is given on VAE Day 1, has not been given in the 2 preceding calendar days, and is given again on VAE Days 3, 5 and 7, there are 7 QADs—because the days between levofloxacin doses also count as QADs.
   - The requirement for 4 consecutive QADs can be met with 4 days of therapy with the same antimicrobial (with a gap of no more than 1 calendar day between administrations of that antimicrobial)—or it can be met with 4 days of therapy with multiple antimicrobial agents, as long as each antimicrobial was started within the VAE Window Period.

EXAMPLE: In the figure below, meropenem would meet the antimicrobial criterion of the IVAC definition because at least one dose was given on 4 consecutive days.

MV Day No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
VAE Criterion	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	**Meropenem**	**Meropenem**	**Meropenem**	**Meropenem**
QAD	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**

EXAMPLE: In the figure below, the 3 drugs shown in bold lettering all qualify as new antimicrobial agents, and therefore the antimicrobial criterion of IVAC is met, since the patient is given 4 consecutive days of new antimicrobial agents.

MV Day No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
VAE Criterion	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent	Ceftriaxone	Ceftriaxone	Ceftriaxone	**Meropenem**	**Imipenem**	**Piperacillin/ Tazobactam**	**Piperacillin/ Tazobactam**
QAD	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**

EXAMPLE: In the figure below, levofloxacin is a new antimicrobial agent (it was started during the VAE Window Period, on MV day 3, and was not given in the 2 days preceding the first day of administration). There are gaps of no more than 1 calendar days between days on which levofloxacin is given, and so the intervening days also count as QADs. In this example, there are 5 QADs (MV days 3-7); therefore the antimicrobial criterion of IVAC is met.

MV Day No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
VAE Criterion	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent			**Levofloxacin**		**Levofloxacin**		**Levofloxacin**
QAD	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

9) There are many patients in my ICU with renal insufficiency and/or who are receiving hemodialysis. These patients may receive certain antimicrobial agents on an infrequent dosing schedule (for example, every 48 hours). How do I determine whether they have received 4 consecutive days of new antimicrobial therapy?
   - See above. You do not need to know the patient's renal function, the dose of the antimicrobial agent, or the frequency of administration. The antimicrobial criterion rules remain the same, regardless of whether patients have renal dysfunction or not.

10) What if the patient is being given one-time doses of intravenous vancomycin? How do I take that into account when using the IVAC surveillance definition?
   - The rules for determining whether the antimicrobial criterion is met do not require that you know the dose or frequency of administration.
   - Make sure that vancomycin qualifies as a new antimicrobial agent—that it was not given in the 2 days preceding the day on which vancomycin was given during the VAE Window Period.
   - Check to see whether there are 4 consecutive QADs with vancomycin; if there are gaps of no more than 1 calendar day between days on which vancomycin is given, the intervening days may be counted as QADs. If there are gaps of longer than 1 calendar day between days of vancomycin therapy, the requirement for 4 consecutive QADs cannot be met using vancomycin alone—but make sure to check whether the 4 consecutive QAD requirement is met by considering any other antimicrobials being administered to the patient.

     EXAMPLE: A patient is given a single dose of vancomycin 1 gram IV on MV day 5. Since vancomycin was started on or after day 3 of mechanical ventilation, and no vancomycin was administered on MV days 2, 3 or 4, vancomycin qualifies as a new antimicrobial agent. A second, single dose of vancomycin 1 gram IV is administered on MV day 8. Because there is a gap of more than 1 calendar day between days of vancomycin administration

(there is a gap of 2 days in this example), the requirement for 4 consecutive QADs is not met, and therefore the IVAC antimicrobial criterion is not met.

MV Day No.	2	3	4	5	6	7	8	9
VAE Criterion	--	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Antimicrobial agent	None	None	None	**Vancomycin 1 gram IV x 1 dose**	None	None	**Vancomycin 1 gram IV x 1 dose**	None
QAD	No	No	No	**Yes**	No	No	**Yes**	No

11) Can I report pathogens or secondary BSIs for VAC and IVAC?

- Pathogens are NOT reported for VAC or IVAC events.
- Secondary BSIs are NOT reported for VAC or IVAC events.

EXAMPLE: A patient hospitalized and mechanically-ventilated in the MICU for 14 days develops worsening oxygenation following a 7-day period of stability on the ventilator. VAC criteria are met on hospital day 15 (stable ventilator settings on days 12 and 13, increased ventilator settings on days 14 and 15). The onset date is day 14. The white blood cell count is noted to be 15,500 cells/mm^3 on day 14. Meropenem and intravenous vancomycin are begun on day 15, administered through the patient's right-sided central line, which was inserted on ICU admission. The antibiotics continue to be administered on day 18, meeting IVAC criteria. Endotracheal aspirate cultures done on days 15 and 16 grow scant upper respiratory flora. A blood culture collected on day 15 is positive for *Klebsiella oxytoca*. There are no other signs or symptoms of infection. This patient should be reported as having an IVAC and a central line-associated BSI. The BSI cannot be reported as secondary to the IVAC event.

12) Can I report pathogens for PVAP?

- Pathogens may be reported for PVAP events, provided they are isolated or identified from appropriate specimen types according to the requirements of the algorithm and are NOT on the list of excluded organisms and culture results:
    - Excluded organisms and culture results that cannot be used to meet the PVAP definition are as follows: "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract; *Candida* species or yeast not otherwise specified; coagulase-negative *Staphylococcus* species; and *Enterococcus* species, when isolated from cultures of sputum, endotracheal aspirates, bronchoalveolar lavage, or protected specimen brushings.

NOTE: When *Candida* species or yeast not otherwise specified, coagulase-negative *Staphylococcus* species or *Enterococcus* species are isolated from cultures of lung tissue or pleural fluid, these organisms may be reported as PVAP pathogens.

Additionally, because organisms belonging to the following genera are usually causes of community-associated respiratory infections and rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet the PVAP definition when isolated from any eligible specimen type (to include lung and pleural fluid): *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.*

- See Table 3 for the required quantitative culture thresholds associated with various specimen types in the PVAP definition. Note that if your laboratory reports semi-quantitative culture results, you should check with your laboratory to confirm that semi-quantitative results match the quantitative thresholds noted in Table 3.

13) Can I report secondary BSIs for PVAP?

- Secondary BSIs may be reported for PVAP events, provided that the organism isolated from the blood culture matches an organism isolated from an appropriate respiratory tract specimen (including respiratory secretions, pleural fluid and lung tissue). The respiratory tract specimen must have been collected within 2 calendar days before or after the day of onset of worsening oxygenation to be considered as a criterion for meeting the PVAP definition. In addition, the positive blood culture must have been collected during the 14-day event period, where day 1 is the day of onset of worsening oxygenation.
    - In cases where PVAP is met with only the histopathology criterion and no culture is performed, and there is also a positive blood culture, a secondary BSI is not reported.
    - In cases where a culture of respiratory secretions, pleural fluid or lung tissue is performed and does not grow an organism that matches an organism isolated from blood, a secondary BSI is not reported.

NOTE: *Candida* species or yeast not otherwise specified, coagulase-negative *Staphylococcus* species, and *Enterococcus* species cultured from blood cannot be deemed secondary to a PVAP, unless the organism was also cultured from pleural fluid or lung tissue.

EXAMPLE: Patient hospitalized and mechanically ventilated in the MICU for 14 days develops worsening oxygenation following a 7-day period of stability on the ventilator. VAC criteria are met on hospital day 15 (stable ventilator settings on days 12 and 13, increased ventilator settings on days 14 and 15). The onset date is day 14. The white blood cell count is noted to be 15,500 cells/mm^3 on day 14. Meropenem and vancomycin are begun on day 15, administered through the patient's right-sided central line (inserted on ICU admission). The antibiotics continue to be administered on day 18, meeting IVAC criteria. Endotracheal

aspirate specimens collected on days 15 and 16 grow ≥ 10^5 CFU/ml *Klebsiella oxytoca*. A blood culture collected on day 15 is positive for *K. oxytoca*. This patient should be reported as having a PVAP with a secondary BSI due to *K. oxytoca*.

EXAMPLE: Patient hospitalized and mechanically ventilated in the MICU for 14 days develops worsening oxygenation following a 7-day period of stability on the ventilator. VAC criteria are met on hospital day 15 (stable ventilator settings on days 12 and 13, increased ventilator settings on days 14 and 15). The onset date is day 14. The white blood cell count is noted to be 15,500 cells/mm^3 on day 14. Meropenem and vancomycin are begun on day 15, administered through the patient's right-sided central line (inserted on ICU admission). The antibiotics continue to be administered on day 18, meeting IVAC criteria. A thoracentesis is performed on day 15 at the patient's bedside using aseptic technique. Pleural fluid is sent for culture and grows *Candida albicans*. A blood culture collected on day 16 is positive for *C. albicans*. This patient should be reported as having a PVAP with a secondary BSI due to *C. albicans.*

EXAMPLE: Patient hospitalized and mechanically ventilated in the MICU for 14 days develops worsening oxygenation following a 7-day period of stability on the ventilator. VAC criteria are met on hospital day 15 (stable ventilator settings on days 12 and 13, increased ventilator settings on days 14 and 15). The onset date is day 14. The white blood cell count is noted to be 15,500 cells/mm^3 on day 14. Meropenem and vancomycin are begun on day 15, administered through the patient's right-sided central line (inserted on ICU admission). The antibiotics continue to be administered on day 18, meeting IVAC criteria. An endotracheal aspirate collected on day 15 is a good quality specimen, with ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field, and grows *Staphylococcus aureus* (qualitative result). A blood culture collected on day 24 is positive for *S. aureus* and for coagulase-negative staphylococci (CoNS). This patient should be reported as having a PVAP, with *S. aureus* reported as the pathogen. A secondary BSI should also be reported for the PVAP, since the positive blood culture was collected within the 14-day period of the VAE, and an organism isolated from blood (*S. aureus*) matched an organism isolated from culture of the endotracheal aspirate. The CoNS also isolated from the blood culture on day 24 is <u>not</u> reported as a pathogen for the PVAP because it is an excluded organism.

14) Can I only report pathogens if they are isolated in cultures of appropriate specimens? What about pathogens identified by non-culture-based diagnostic testing?
    - PVAP incorporates results of non-culture-based microbiological diagnostic testing. For PVAP, pathogens that are grown in culture OR selected pathogens that are identified as a result of other laboratory testing (e.g., antigen testing, PCR, immunohistochemistry, etc.) should be reported. Do not limit reporting to just those organisms isolated in culture. For example, influenza A identified by polymerase chain reaction (PCR) in a patient meeting PVAP criteria should be reported as a pathogen for that event.

15) The "PVAP" criterion 3 includes "positive diagnostic tests" for *Legionella* species, and selected viruses. What kinds of diagnostic tests can be used to meet the definition?
    - Diagnostic testing practices may vary from facility to facility and change over time as better tests are developed. Listed here are some examples of diagnostic tests for specific pathogens included in the PVAP definition. Positive results of these tests may be used in meeting the PVAP definition. Your facility may use other testing methods; positive results obtained using these methods may also be appropriate for use in meeting the PVAP definition. If you have a question regarding a diagnostic test method, check with your laboratory.
    - For *Legionella* species, positive results of any of the following, performed on the appropriate specimen: urinary antigen, *Legionella*-specific respiratory culture, paired serology (4-fold rise in titer between acute and convalescent specimens), direct fluorescent antibody stain, immunohistochemistry stain, or nucleic acid detection assays (such as PCR) performed on a respiratory specimen.
    - For respiratory viruses (influenza, respiratory syncytial virus [RSV], parainfluenza viruses, human metapneumovirus, coronaviruses, rhinoviruses and adenovirus), positive results for any of the following:
        - Performed on an appropriate respiratory specimens – PCR or other viral nucleic acid detection methods, antigen detection methods, including rapid tests, viral cell culture, or
        - Performed on appropriate pathologic specimens – immunohistochemical assays, cytology, microscopy, or
        - Performed on appropriately timed paired sera (acute and convalescent) – serological assays demonstrating seroconversion or a significant rise in antibody titer.

16) What about pneumonitis that occurs in a mechanically-ventilated patient and is determined to be due to herpes simplex virus (HSV) or cytomegalovirus (CMV)? Can these infections be reported as VAEs?
    - In most cases pneumonitis due to HSV and CMV represents reactivation of a latent infection, and therefore would not be considered healthcare-associated, according to the NHSN definition of a healthcare-associated infection.

17) Are there any culture results or microorganisms that CANNOT be used to meet the PVAP definition?

- The following pathogens and culture results may NOT be used to meet the definition and may NOT be reported as causes of PVAP when they are obtained from cultures of sputum, endotracheal aspirates, bronchoalveolar lavages or protected specimen brushings:
    - Culture results reported as "Normal respiratory flora," "normal oral flora," "mixed respiratory flora," "mixed oral flora," "altered oral flora" or other similar results indicating isolation of commensal flora of the oral cavity or upper respiratory tract.
    - *Candida* species or yeast not otherwise specified
    - Coagulase-negative *Staphylococcus* species
    - *Enterococcus* species

  NOTE: These organisms are excluded because they are common upper respiratory tract commensals, colonizers or contaminants, and are unusual causes of VAP. Their exclusion from the surveillance definitions should NOT be used in clinical decision-making regarding patient treatment. Providers must independently determine the clinical significance of these organisms isolated from respiratory specimen cultures and the need for treatment.

  NOTE: When *Candida* species or yeast not otherwise specified, coagulase-negative *Staphylococcus* species or *Enterococcus* species are isolated from cultures of lung tissue or pleural fluid, these organisms may be reported as PVAP pathogens.

  Additionally, because organisms belonging to the following genera are typically causes of community-associated respiratory infections and are rarely or are not known to be causes of healthcare-associated infections, they are also excluded, and cannot be used to meet the PVAP definition when isolated from any eligible specimen type (to include lung and pleural fluid): *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis.*

- When sputum, endotracheal aspirate, bronchoalveolar lavage or protected specimen brushing culture results are mixed and contain one or more of the excluded pathogens in addition to one or more non-excluded pathogens, the culture may be used to meet the PVAP definition (depending on whether a qualitative, semi-quantitative or quantitative culture was performed, and whether the semi-quantitative or quantitative cfu/ml thresholds were met) BUT only the non-excluded pathogen(s) should be reported.

EXAMPLE: Patient intubated and mechanically ventilated in the MSICU meets IVAC criteria on day 8 of mechanical ventilation. On the day after the onset of worsening oxygenation, an endotracheal aspirate is collected. The Gram stain shows ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field, and the culture grows "heavy *Staphylococcus aureus*" and "heavy *Candida albicans*." This patient should be reported as having a PVAP (criterion1) due to *Staphylococcus aureus* – as long as the semi-quantitative result "heavy" is equivalent to the quantitative threshold of ≥ 10^5 cfu/ml for endotracheal aspirates. If the semi-quantitative result is not equivalent to the the quantitative threshold of ≥ 10^5 cfu/ml for endotracheal aspirates, the patient should still be reported as PVAP (criterion 2). *Candida albicans* from the endotracheal aspirate culture is not reported, because it is an excluded result.

18) What about pleural fluid cultures and lung tissue cultures? Can I report any pathogen isolated from a lung tissue culture, or from a pleural fluid culture, assuming the specimen was obtained during thoracentesis or at the time of chest tube insertion?

- Any pathogen cultured from lung tissue, when that lung tissue was obtained during an open lung biopsy, video-assisted thoracoscopic surgery, or via other transthoracic or transbronchial biopsy approach, may be reported with the exception of the excluded pathogens belonging to the following genera: *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis*.
- Any pathogen cultured from pleural fluid, when that fluid was obtained during thoracentesis or at the time of initial chest tube insertion, may be reported with the exception of the excluded pathogens belonging to the following genera: *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus and Pneumocystis*.

19) How are "purulent respiratory secretions" defined?

- Purulent respiratory secretions used to meet Criterion #2 of the PVAP definition are defined as:
    - Secretions from the lungs, bronchi, or trachea with ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field [lpf, x100].
    - If the laboratory reports semi-quantitative results, you should check with your laboratory to be certain that the semi-quantitative results match the quantitative thresholds noted above.
- If your laboratory is not able to provide additional information on how a semi-quantitative reporting system corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells, here is some guidance from the *Clinical Microbiology Procedures Handbook* (3rd ed., 2010)*:

    1+ = occasional or rare = <1 cell per low power field [lpf, x100]
    2+ = few = 1-9 cells per low power field [lpf, x100]
    3+ = moderate = 10-25 cells per low power field [lpf, x100]
    4+ = heavy = >25 cells per low power field [lpf, x100]

- With this range in mind, and in the absence of additional information from your laboratory, "purulent respiratory secretions" are defined as secretions that contain heavy, 4+ or ≥25 neutrophils per low power field [lpf, x100] AND rare, occasional, few, 1+ or 2+, or ≤10 squamous epithelial cells per low power field [lpf, x100].
  *Reference: Garcia, LS (Ed.). (2010). Clinical Microbiology Procedures Handbook. Herndon, VA: ASM Press, page 3.2.1.16.

- If your laboratory uses a different reporting format for results of direct examination of respiratory secretions, you may still be able to use the purulent respiratory secretions in meeting the PVAP definition. See the instructions available in the VAE Protocol, Table 2.

20) What is the definition of "positive lung histopathology" that can be used to meet the PVAP definition?

- If the lung tissue specimen was obtained via open lung biopsy, video-assisted thoracoscopic surgery, or via other transthoracic or transbronchial biopsy approach, it is eligible for consideration in meeting the PVAP definition (Criterion 3).
- Histopathological findings that can be used to meet the PVAP definition include:
  - Abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli;
  - Evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms);
  - Evidence of infection with the viral pathogens listed in FAQ no. 14 based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue.

21) I am still having trouble understanding the time frame that defines a VAE. Can you explain what is meant by this statement that appears in the algorithm: *"On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation"*?

- The intent of these criteria is to determine whether a VAC is due to an infectious process (IVAC) and/or pneumonia (PVAP) by looking for corroborating inflammatory and infectious signs at the time of VAC onset. The criterion, "on or after calendar day 3" is intended to exclude inflammatory and infectious signs present on the first two days of mechanical ventilation because they are more likely to be due to pre-existing conditions than ventilator-acquired complications. The criterion, "within 2 calendar days before or after the onset of worsening oxygenation," is intended to identify infectious and inflammatory signs that arise at the same time as VAC and may therefore point to the cause of the VAC. +
- The figures below illustrate the time frame that defines a VAE. The event date is the first day of worsening oxygenation, defined by the PEEP and FiO_2 thresholds outlined in the algorithm. The event date defines the time frame within which all other criteria must be met. In the examples below, the shaded area defines the VAE Window Period in which IVAC criteria (temperature or white count abnormalities,

plus a new antimicrobial agent started and continued for at least 4 days) must be met, and in which a PVAP criterion must be met.

NOTE: Keep in mind that VAE criteria must be met based on specimens collected or antimicrobial agents started after day 2 of mechanical ventilation.

EXAMPLE 1: When the onset date of the VAE occurs early in the course of mechanical ventilation (e.g., day 3 or 4 of mechanical ventilation), the period in which certain inflammatory and infectious criteria are sought for IVAC and PVAP is shorter, because the first 2 days of mechanical ventilation are excluded from the normal 5 day window surrounding the day of increased ventilator support.

MV Day No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Worsening oxygenation	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Temperature abnormality or white blood cell count abnormality			←An abnormal temperature or white blood cell count, according to the algorithm parameters, must be documented within this shaded period→				
Antimicrobial agent			←New agent must be started on any day within this shaded period, and then continued for at least 4 days→				
Purulent respiratory secretions, positive culture, positive histopathology			←Specimen must be collected on any day within this shaded period→				

EXAMPLE 2: When the onset date of the VAE occurs later in the course of mechanical ventilation, the period in which certain criteria must be met is a day longer, because the patient has already been on mechanical ventilation for more than 3 days and therefore inflammatory and infectious signs arising anywhere in the full 5-day window surrounding the day of increased ventilator settings can count towards IVAC and PVAP.

MV Day No.	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Worsening oxygenation	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
Temperature abnormality or white blood cell count abnormality		←An abnormal temperature or white blood cell count, according to the algorithm parameters, must be documented within this shaded period→					
Antimicrobial agent		←New agent must be started on any day within this shaded period, and then continued for at least 4 days→					
Purulent respiratory secretions, positive culture, positive histopathology		←Specimen must be collected on any day within this shaded period→					

22) Providers in my ICU use different types of mechanical ventilation for different patients. Can you explain the circumstances in which mechanically-ventilated patients are to be excluded from VAE surveillance, and the circumstances in which mechanically-ventilated patients should be included in VAE surveillance?

- VAE surveillance is restricted to adult inpatient locations. Patients on mechanical ventilation who are in adult inpatient locations in acute care and long-term acute care hospitals and inpatient rehabilitation facilities are eligible for inclusion in VAE surveillance.
- Patients are excluded from VAE surveillance during periods of time when they are receiving high frequency ventilation, or if they are receiving extracorporeal life support (extracorporeal membrane oxygenation).
- Patients are included in surveillance if they are on a ventilator (as defined in the VAE surveillance protocol), and are being mechanically ventilated through an endotracheal or tracheostomy tube using a conventional mode of mechanical ventilation (such as volume controlled, pressure controlled, or pressure support mechanical ventilation).
    - Patients on conventional mechanical ventilation who are receiving nitric oxide, helium-oxygen mixtures (heliox) or epoprostenol therapy are included in surveillance.
    - Patients on conventional mechanical ventilation who are being ventilated in the prone position are included in surveillance.
- Patients are also included in surveillance if they are on a ventilator (as defined in the VAE surveillance protocol), and are being mechanically ventilated through an endotracheal or tracheostomy tube using Airway Pressure Release Ventilation (APRV) or related modes. Some terms that are used to indicate APRV or a related mode of mechanical ventilation include (but may not be limited to): BiLevel, Bi Vent, BiPhasic, PCV+, and DuoPAP.
    - For patients on APRV or related modes, the period of worsening oxygenation following a period of stability or improvement on the ventilator that is required for identification of a VAE will be defined by the FiO_2 criterion within the VAE surveillance definition algorithm. The PEEP criterion may not be applicable in patients on APRV or related modes of mechanical ventilation.
- If you have questions about mechanical ventilation, you should check with the Respiratory Care or Respiratory Therapy and/or Critical Care departments in your facility.

23) Why do I need to indicate if a patient was on APRV at the time of VAE onset, and why do I need to indicate the number of patients on APRV in my ICU for each day of VAE surveillance?

- We are trying to find out more about how frequently APRV and related modes of mechanical ventilation are being used, and the frequency with which VAEs are identified in patients on APRV and related modes, to determine whether the VAE surveillance definition algorithm may need to be modified in the future.

- If the VAE occurred in a patient on Airway Pressure Release Ventilation (APRV) or a related mode of mechanical ventilation (e.g., BiLevel, Bi Vent, BiPhasic, PCV+, DuoPAP) at the time of VAE onset, indicate "Yes" in the "APRV" field on the VAE Form (CDC 57.112). Otherwise, indicate "No."
- On the appropriate denominator form (CDC 57.117 or 57.118); in the column for "Number of patients on a ventilator," you will see that there are two sub-columns. In the sub-column, "Total patients," enter the total number of patients on a ventilator on that day. In the sub-column, "Number on APRV," enter the number for the subset of patients on a ventilator on that day who are on the APRV mode of mechanical ventilation or related modes (e.g., BiLevel, Bi Vent, BiPhasic, PCV+, DuoPAP) at the time the count is performed. If there are no patients on APRV or a related mode of mechanical ventilation, enter "0" (zero).

24) My laboratory only performs semi-quantitative cultures of lower respiratory tract specimens, and cannot provide me with additional guidance to help me know what semi-quantitative culture result corresponds to the quantitative thresholds specified in Criterion1 of the PVAP definition. Can you provide more information?

- For the purposes of this surveillance, and in the absence of additional information available from your laboratory, a semi-quantitative result of "moderate" or "heavy" growth, or 2+, 3+ or 4+ growth, meets the PVAP definition (Criterion 1).

Surgical Site Infection (SSI) Event

Introduction: In 2010, an estimated 16 million operative procedures were performed in acute care hospitals in the United States[1]. A recent prevalence study found that SSIs were the most common healthcare-associated infection, accounting for 31% of all HAIs among hospitalized patients[2]. The CDC healthcare-associated infection (HAI) prevalence survey found that there were an estimated 157,500 surgical site infections associated with inpatient surgeries in 2011[3]. NHSN data for 2006-2008 (16,147 SSIs following 849,659 operative procedures) showed an overall SSI rate of 1.9%[4].

While advances have been made in infection control practices, including improved operating room ventilation, sterilization methods, barriers, surgical technique, and availability of antimicrobial prophylaxis, SSIs remain a substantial cause of morbidity, prolonged hospitalization, and death. SSI is associated with a mortality rate of 3%, and 75% of SSI-associated deaths are directly attributable to the SSI[5].

Surveillance of SSI with feedback of appropriate data to surgeons has been shown to be an important component of strategies to reduce SSI risk[6-9]. A successful surveillance program includes the use of epidemiologically-sound infection definitions and effective surveillance methods, stratification of SSI rates according to risk factors associated with SSI development, and data feedback[7,8]. A new CDC and Healthcare Infection Control Practices Advisory Committee guideline for the prevention of surgical site infection is scheduled for publication soon, and will replace the previous *Guideline for Prevention of Surgical Site Infection, 1999*[9].

Settings: Surveillance of surgical patients will occur in any inpatient and/or outpatient setting where the selected NHSN operative procedure(s) are performed.

Requirements: Perform surveillance for SSI following at least one NHSN operative procedure category (Table 1) as indicated in the *Patient Safety Monthly Reporting Plan* (CDC 57.106). Collect SSI (numerator) and operative procedure category (denominator) data on all procedures included in the selected procedure categories for at least one month to meet NHSN requirements, or as otherwise specified by mandates and other reporting requirements. A procedure must meet the NHSN definition of an operative procedure in order to be included in the surveillance. All procedures included in the NHSN monthly surveillance plan are followed for superficial, deep, and organ space SSIs.

SSI monitoring requires active, patient-based, prospective surveillance. Post-discharge and ante-discharge surveillance methods should be used to detect SSIs following inpatient and outpatient operative procedures. These methods include, 1) direct examination of patients' wounds during follow-up visits to either surgery clinics or physicians' offices, 2) review of medical records or surgery clinic patient records, 3) surgeon surveys by mail or telephone, and 4) patient surveys by mail or telephone (though patients may have a difficult time assessing their infections). Any combination of these methods is acceptable for use; however, CDC

criteria for SSI must be used. To minimize Infection Preventionists' (IPs) workload of collecting denominator data, operating room data may be downloaded (see file specifications at: http://www.cdc.gov/nhsn/PDFs/ImportingProcedureData_current.pdf).

An SSI will be associated with a particular NHSN operative procedure and the facility in which that procedure was performed. Refer to the NHSN application's Help system for instruction on linking an SSI to an operative procedure.

The *International Classification of Diseases, 9th Revision Clinical Modifications* (ICD-9-CM) codes, which are defined by the ICD-9 Coordination and Maintenance Committee of the National Center for Health Statistics and the Centers for Medicare and Medicaid Services (CMS), are developed as a tool for classification of morbidity data. The wide use enables the grouping of surgery types for the purpose of determining SSI rates. Table 1 lists NHSN operative procedure category groupings by ICD-9-CM codes. Because ambulatory surgery centers and hospital outpatient surgery departments may not use ICD-9-CM procedure codes, Table 1 provides Current Procedural Terminology (CPT) code mapping for certain NHSN operative procedure categories to assist users in determining the correct NHSN code to report for outpatient surgery cases. However, when available, ICD-9-CM codes take precedence over CPT codes when determining the appropriate NHSN operative procedure category for inpatient surgery cases. Table 1 also includes a general description of the types of operations contained in the NHSN operative procedure categories.

CDC continues to work on updated ICD-10-CM/PCS and CPT mappings to all NHSN operative procedure categories for SSI surveillance. These mappings are anticipated to be available by March 2015.

Note: ICD-10-CM/PCS codes will replace ICD-9-CM codes on October 1, 2015, however NHSN will not have the ability to receive these codes until the January 2016 release. The NHSN guidance for entry of surgical denominator data for the last quarter of 2015 data is to enter the NHSN Procedure Code (e.g. COLO or HYST); but do not enter any ICD-10-CM/PCS codes associated with the procedure.

Note: The infection window, Present on Admission, Hospital Associated Infection and Repeat Infection Timeframe definitions should **not** be applied to the SSI protocol.

Definition of an NHSN Operative Procedure

An NHSN Operative Procedure is a Procedure:

- that is included in Table 1
  And
- takes place during an operation where at least one incision (including laparoscopic approach) is made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure
  And

- takes place in an operating room (OR), defined as a patient care area that met the Facilities Guidelines Institute's (FGI) or American Institute of Architects' (AIA) criteria for an operating room when it was constructed or renovated[10]. This may include an operating room, C-section room, interventional radiology room, or a cardiac catheterization lab.

Exclusions: Otherwise eligible procedures that are assigned an ASA score of 6 are not eligible for NHSN SSI surveillance

Note: Incisional closure method is NOT a part of the NHSN operative procedure definition; all otherwise eligible procedures are included, regardless of closure type. Therefore both primarily closed procedures and those that are not closed primarily should be entered into the denominator data for procedures in the facility's monthly reporting plan. Any SSIs attributable to either primarily closed or non-primarily closed procedures should be reported.

Table 1. NHSN Operative Procedure Category Mappings to ICD-9-CM Codes and CPT Codes

Notes:

- NHSN will provide updates as needed concerning the transition from ICD-9-CM to ICD-10-CM/PCS procedure coding.
- When available, ICD-9-CM codes take precedence over CPT codes when determining the appropriate NHSN operative procedure category for inpatient surgery cases.

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
AAA	Abdominal aortic aneurysm repair	Resection of abdominal aorta with anastomosis or replacement	38.34, 38.44, 38.64
AMP	Limb amputation	Total or partial amputation or disarticulation of the upper or lower limbs, including digits	84.00-84.19, 84.91
APPY	Appendix surgery	Operation of appendix **Note:** incidental APPY codes are not part of this procedure group and do not need to be reported.	47.01, 47.09, 47.2, 47.91, 47.92, 47.99
AVSD	Shunt for dialysis	Arteriovenostomy for renal dialysis	39.27, 39.42

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
BILI	Bile duct, liver or pancreatic surgery	Excision of bile ducts or operative procedures on the biliary tract, liver or pancreas (does not include operations only on gallbladder)	50.0, 50.12, 50.14, 50.21-50.23, 50.25, 50.26, 50.29, 50.3, 50.4, 50.61, 50.69, 51.31-51.37, 51.39, 51.41-51.43, 51.49, 51.51, 51.59, 51.61-51.63, 51.69, 51.71, 51.72, 51.79, 51.81-51.83, 51.89, 51.91-51.95, 51.99, 52.09, 52.12, 52.22, 52.3**,** 52.4, 52.51-52.53, 52.59-52.6, 52.7, 52.92, 52.95, 52.96, 52.99
BRST	Breast surgery	Excision of lesion or tissue of breast including radical, modified, or quadrant resection, lumpectomy, incisional biopsy, or mammoplasty	85.12, 85.20-85.23, 85.31-85.36, 85.41-85.48, 85.50, 85.53-85.55, 85.6, 85.70-85.76, 85.79, 85.93-85.96 19101, 19112, 19120, 19125, 19126, 19300, 19301, 19302, 19303, 19304, 19305, 19306, 19307, 19316, 19318, 19324, 19325, 19328, 19330, 19340, 19342, 19350, 19355, 19357, 19361, 19364, 19366, 19367, 19368, 19369, 19370, 19371, 19380
CARD	Cardiac surgery	Procedures on the heart; includes valves or septum; does not include coronary artery bypass graft, surgery on vessels, heart transplantation, or pacemaker implantation	35.00-35.04, 35.06, 35.08, 35.10-35.14, 35.20-35.28, 35.31-35.35, 35.39, 35.42, 35.50, 35.51, 35.53, 35.54, 35.60-35.63, 35.70-35.73, 35.81-35.84, 35.91-35.95, 35.98-35.99, 37.10-37.12, 37.31-37.33, 37.35-37.37, 37.41, 37.49, 37.60
CEA	Carotid endarterectomy	Endarterectomy on vessels of head and neck (includes carotid artery and jugular vein)	38.12
CBGB	Coronary artery bypass graft with **both** chest and donor site incisions	Chest procedure to perform direct revascularization of the heart; includes obtaining suitable vein from donor site for grafting	36.10-36.14, 36.19

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
CBGC	Coronary artery bypass graft with chest incision only	Chest procedure to perform direct vascularization of the heart using, for example the internal mammary (thoracic) artery	36.15-36.17, 36.2
CHOL	Gallbladder surgery	Cholecystectomy and cholecystotomy	51.03, 51.04, 51.13, 51.21-51.24 47480, 47562, 47563, 47564, 47600, 47605, 47610, 47612, 47620
COLO	Colon surgery	Incision, resection, or anastomosis of the large intestine; includes large-to-small and small-to-large bowel anastomosis For rectal procedures see the REC codes.	17.31-17.36, 17.39, 45.03, 45.26, 45.41, 45.49, 45.52, 45.71-45.76, 45.79, 45.81-45.83, 45.92-45.95, 46.03, 46.04, 46.10, 46.11, 46.13, 46.14, 46.43, 46.52, 46.75, 46.76, 46.94 44140, 44141, 44143, 44144, 44145, 44146, 44147, 44150, 44151, 44160, 44204, 44205, 44206, 44207, 44208, 44210
CRAN	Craniotomy	Excision repair, or exploration of the brain or meninges; does not include taps or punctures	01.12, 01.14, 01.20-01.25, 01.28, 01.29, 01.31, 01.32, 01.39, 01.41, 01.42, 01.51-01.53, 01.59, 02.11-02.14, 02.91-02.93, 07.51-07.54, 07.59, 07.61-07.65, 07.68, 07.69, 07.71, 07.72, 07.79, 38.01, 38.11, 38.31, 38.41, 38.51, 38.61, 38.81, 39.28
CSEC	Cesarean section	Obstetrical delivery by Cesarean section	74.0, 74.1, 74.2, 74.4, 74.91, 74.99
FUSN	Spinal fusion	Immobilization of spinal column	81.00-81.08
FX	Open reduction of fracture	Open reduction of fracture or dislocation of long bones with or without internal or external fixation; does not include placement of joint prosthesis	79.21, 79.22, 79.25, 79.26, 79.31, 79.32, 79.35, 79.36, 79.51, 79.52, 79.55, 79.56 23615, 23616, 23630, 23670, 23680, 24515, 24516, 24538, 24545, 24546, 24575, 24579, 24586, 24587, 24635, 24665, 24666, 24685, 25337, 25515, 25525, 25526, 25545, 25574, 25575, 25607, 25608, 25609, 25652, 27236, 27244, 27245, 27248, 27254, 27269, 27283,

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
			27506, 27507, 27511, 27513, 27514, 27535, 27536, 27540, 27758, 27759, 27766, 27769, 27784, 27792, 27814, 27822, 27826, 27827, 27828
GAST	Gastric surgery	Incision or excision of stomach; includes subtotal or total gastrectomy; does not include vagotomy and fundoplication	43.0, 43.42, 43.49, 43.5, 43.6, 43.7, 43.81, 43.82, 43.89, 43.91, 43.99, 44.15, 44.21, 44.29, 44.31, 44.38-44.42, 44.49, 44.5, 44.61-44.65, 44.68-44.69, 44.95-44.98
HER	Herniorrhaphy	Repair of inguinal, femoral, umbilical, or anterior abdominal wall hernia; does not include repair of diaphragmatic or hiatal hernia or hernias at other body sites	17.11-17.13, 17.21-17.24, 53.00-53.05, 53.10-53.17, 53.21, 53.29, 53.31, 53.39, 53.41-53.43, 53.49, 53.51, 53.59, 53.61-53.63, 53.69 49491, 49492, 49495, 49496, 49500, 49501, 49505, 49507, 49520, 49521, 49525, 49550, 49553, 49555, 49557, 49560, 49561, 49565, 49566, 49568, 49570, 49572, 49580, 49582, 49585, 49587, 49590, 49650, 49651, 49652, 49653, 49654, 49655, 49656, 49657, 49659, 55540
HPRO	Hip prosthesis	Arthroplasty of hip	00.70-00.73, 00.85-00.87, 81.51-81.53 27125, 27130, 27132, 27134, 27137, 27138, 27236, 27299
HTP	Heart transplant	Transplantation of heart	37.51-37.55
HYST	Abdominal hysterectomy	Abdominal hysterectomy; includes that by laparoscope	68.31, 68.39, 68.41, 68.49, 68.61, 68.69 58150, 58152, 58180, 58200, 58210, 58541, 58542, 58543, 58544, 58548, 58570, 58571, 58572, 58573, 58951, 58953, 58954, 58956

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
KPRO	Knee prosthesis	Arthroplasty of knee	00.80-00.84, 81.54, 81.55 27438, 27440, 27441, 27442, 27443, 27445, 27446, 27447, 27486, 27487
KTP	Kidney transplant	Transplantation of kidney	55.61, 55.69
LAM	Laminectomy	Exploration or decompression of spinal cord through excision or incision into vertebral structures	03.01, 03.02, 03.09, 80.50, 80.51, 80.53, 80.54, 80.59, 84.60-84.69, 84.80-84.85
LTP	Liver transplant	Transplantation of liver	50.51, 50.59
NECK	Neck surgery	Major excision or incision of the larynx and radical neck dissection; does not include thyroid and parathyroid operations	30.1, 30.21, 30.22, 30.29, 30.3, 30.4, 31.45, 40.40-40.42
NEPH	Kidney surgery	Resection or manipulation of the kidney with or without removal of related structures	55.01, 55.02, 55.11, 55.12, 55.24, 55.31, 55.32, 55.34, 55.35, 55.39, 55.4, 55.51, 55.52, 55.54, 55.91
OVRY	Ovarian surgery	Operations on ovary and related structures	65.01, 65.09, 65.12, 65.13, 65.21-65.25, 65.29, 65.31, 65.39, 65.41, 65.49, 65.51-65.54, 65.61-65.64, 65.71-65.76, 65.79, 65.81, 65.89, 65.92-65.95, 65.99
PACE	Pacemaker surgery	Insertion, manipulation or replacement of pacemaker	00.50-00.54, 17.51, 17.52, 37.70-37.77, 37.79-37.83, 37.85-37.87, 37.89, 37.94-37.99
PRST	Prostate surgery	Suprapubic, retropubic, radical, or perineal excision of the prostate; does not include transurethral resection of the prostate	60.12, 60.3, 60.4, 60.5, 60.61, 60.69
PVBY	Peripheral vascular bypass surgery	Bypass operations on peripheral arteries	39.29
REC	Rectal surgery	Operations on rectum	48.25, 48.35, 48.40, 48.42, 48.43, 48.49-48.52, 48.59, 48.61-48.65, 48.69, 48.74
RFUSN	Refusion of spine	Refusion of spine	81.30-81.39

Legacy Code	Operative Procedure	Description	ICD-9-CM Codes / CPT Codes
SB	Small bowel surgery	Incision or resection of the small intestine; does not include small-to-large bowel anastomosis	45.01, 45.02, 45.15, 45.31-45.34, 45.51, 45.61-45.63, 45.91, 46.01, 46.02, 46.20-46.24, 46.31, 46.39, 46.41, 46.51, 46.71-46.74, 46.93
SPLE	Spleen surgery	Resection or manipulation of spleen	41.2, 41.33, 41.41-41.43, 41.5, 41.93, 41.95, 41.99
THOR	Thoracic surgery	Noncardiac, nonvascular thoracic surgery; includes pneumonectomy and hiatal hernia repair or diaphragmatic hernia repair (except through abdominal approach)	32.09, 32.1, 32.20-32.23, 32.25, 32.26, 32.29, 32.30, 32.39, 32.41, 32.49, 32.50, 32.59, 32.6, 32.9, 33.0, 33.1, 33.20, 33.25, 33.28, 33.31-33.34, 33.39, 33.41-33.43, 33.48, 33.49, 33.98, 33.99, 34.01-34.03, 34.06, 34.1, 34.20, 34.26, 34.3, 34.4, 34.51, 34.52, 34.59, 34.6, 34.81-34.84, 34.89, 34.93, 34.99, 53.80-53.84
THYR	Thyroid and/or parathyroid surgery	Resection or manipulation of thyroid and/or parathyroid	06.02, 06.09, 06.12, 06.2, 06.31, 06.39, 06.4, 06.50-06.52, 06.6, 06.7, 06.81, 06.89, 06.91-06.95, 06.98, 06.99
VHYS	Vaginal hysterectomy	Vaginal hysterectomy; includes that by laparoscope	68.51, 68.59, 68.71, 68.79
VSHN	Ventricular shunt	Ventricular shunt operations, including revision and removal of shunt	02.21, 02.22, 02.31-02.35, 02.39, 02.42, 02.43, 54.95[†]
XLAP	Exploratory laparotomy	Procedures involving an incision through abdominal wall to gain access into the abdominal cavity; diagnostic procedure on abdominal region	53.71, 53.72, 53.75, 54.0, 54.11, 54.12, 54.19, 54.3, 54.4, 54.51, 54.59, 54.61, 54.63, 54.64, 54.71-54.75, 54.92, 54.93

[†]Include only if this procedure involves ventricular shunt (i.e., is not a Ladd procedure to repair malrotation of intestines).

For a complete list of all ICD-9-CM codes mapped to their assignment as an NHSN operative procedure category, a surgical procedure other than an NHSN operative procedure (OTH), or a non-operative procedure (NO), see ICD-9-CM Procedure Code Mapping to NHSN Operative Procedure Categories at http://www.cdc.gov/nhsn/XLS/ICD-9-cmCODEScurrent.xlsx.

Denominator for Procedure Definitions:

ASA physical status: Assessment by the anesthesiologist of the patient's preoperative physical condition using the American Society of Anesthesiologists' (ASA) Classification of Physical Status[11,12]. Patient is assigned one of the following:

1. A normally healthy patient
2. A patient with mild systemic disease
3. A patient with severe systemic disease
4. A patient with severe systemic disease that is a constant threat to life
5. A moribund patient who is not expected to survive without the operation.

Note: Do NOT report procedures with an ASA physical status of 6 (a declared brain-dead patient whose organs are being removed for donor purposes) to NHSN.

Date of event (DOE): For an SSI the date of event is the date when the first element used to meet the SSI infection criterion occurs for the first time during the surveillance period. Synonym: infection date.

Diabetes: The NHSN SSI surveillance definition of diabetes indicates that the patient has a diagnosis of diabetes requiring management with insulin or a non-insulin anti-diabetic agent. This includes patients with "insulin resistance" who are on management with anti-diabetic agents. This also includes patients with a diagnosis of diabetes who are noncompliant with their diabetes medications. The discharge ICD-9-CM codes in the 250 to 250.93 range are also acceptable for use to answer YES to the diabetes field question.
The NHSN definition excludes patients with no diagnosis of diabetes. The definition excludes patients who receive insulin for perioperative control of hyperglycemia but have no diagnosis of diabetes.

Duration of operative procedure: The interval in hours and minutes between the Procedure/Surgery Start Time, and the Procedure/Surgery Finish Time, as defined by the Association of Anesthesia Clinical Directors (AACD)[13]:

- Procedure/Surgery Start Time (PST): Time when the procedure is begun (*e.g.*, incision for a surgical procedure).
- Procedure/Surgery Finish (PF): Time when all instrument and sponge counts are completed and verified as correct, all postoperative radiologic studies to be done in the OR are completed, all dressings and drains are secured, and the physicians/surgeons have completed all procedure-related activities on the patient.

Emergency operative procedure: A nonelective, unscheduled operative procedure. Emergency operative procedures are those that do not allow for the standard immediate preoperative preparation normally done within the facility for a scheduled operation (e.g., stable vital signs, adequate antiseptic skin preparation, colon decontamination in advance of colon surgery, etc.).

General anesthesia: The administration of drugs or gases that enter the general circulation and affect the central nervous system to render the patient pain free, amnesic, unconscious, and often paralyzed with relaxed muscles.

Height: The patient's most recent height documented in the medical record in feet (ft.) and inches (in), or meters (m).

NHSN Inpatient Operative Procedure: An NHSN operative procedure performed in an acute care Inpatient Operating Room (OR) area or suite which meets the NHSN definition of an operating room (see key terms). If the majority of patients undergoing procedures in this OR area are intended to be admitted to an inpatient unit, then all of the procedures from this OR area will be considered inpatient procedures.

Note: the 80/20 rule for mapping locations does not apply for determining the inpatient OR suite status.

NHSN Outpatient Operative Procedure: An NHSN operative procedure performed in an outpatient Operating Room (OR) area or suite. If the majority of patients undergoing procedures in this OR area are not intended to be admitted to an inpatient unit, then all of the procedures from this OR area will be considered outpatient procedures.

Note: the 80/20 rule for mapping locations does not apply for determining the outpatient OR suite status.

Note: If the facility has only ***one*** OR area and they perform all of their inpatient and outpatient procedures in this same OR area, it should be considered an inpatient OR and all procedures performed in this area are considered inpatient procedures.

Non-primary Closure is defined as closure that is other than primary and includes surgeries in which the skin level is left completely open during the original surgery and therefore cannot be classified as having primary closure. For surgeries with non-primary closure, the deep tissue layers may be closed by some means (with the skin level left open), or the deep and superficial layers may both be left completely open. An example of a surgery with non-primary closure would be a laparotomy in which the incision was closed to the level of the deep tissue layers, sometimes called "fascial layers" or "deep fascia," but the skin level was left open. Another example would be an "open abdomen" case in which the abdomen is left completely open after the surgery. Wounds with non-primary closure may or may not be described as "packed" with gauze or other material, and may or may not be covered with plastic, "wound vacs," or other synthetic devices or materials.

Primary Closure is defined as closure of the skin level during the original surgery, regardless of the presence of wires, wicks, drains, or other devices or objects extruding through the incision. This category includes surgeries where the skin is closed by some means. Thus, if any portion of the incision is closed at the skin level, by any manner, a designation of primary closure should be assigned to the surgery.

Note: If a procedure has multiple incision/laparoscopic trocar sites and any of the incisions are closed primarily then the procedure technique is recorded as primary closed.

Scope: An instrument used to visualize the interior of a body cavity or organ. In the context of an NHSN operative procedure, use of a scope involves creation of several small incisions to perform or assist in the performance of an operation rather than use of a traditional larger incision (i.e., open approach). Robotic assistance is considered equivalent to use of a scope for NHSN SSI surveillance. See also Instructions for Completion of *Denominator for Procedure* Form and both Numerator Data and Denominator Data reporting instructions in this chapter.

Note: If a scope site has to be extended for hand assist or removal of specimen this will still meet scope = Yes. If the procedure is converted to an open procedure it will be scope = No.

Secondary BSI Attribution Period: The secondary BSI attribution period for SSI is a 17-day period that includes the date of event, 3 days prior and 13 days after.

Trauma: Blunt or penetrating injury occurring prior to the start of the procedure.

Weight: The patient's most recent weight documented in the medical record in pounds (lbs.) or kilograms (kg) prior to or otherwise closest to the procedure.

Wound class: An assessment of the degree of contamination of a surgical wound at the time of the operation. Wound class should be assigned by a person involved in the surgical procedure (e.g., surgeon, circulating nurse, etc.). The wound class system used in NHSN is an adaptation of the American College of Surgeons wound classification schema.

There are a group of NHSN procedures that can never be coded as clean. NHSN reached the decision regarding which NHSN operative procedures can never be classified as clean based on feedback from external experts in the field of surgery.

The procedures that can never be entered as clean are: APPY, BILI, CHOL, COLO, REC, SB and VHYS. Therefore, for these procedures in the application clean is not an option on the drop down menu.

For all other procedures clean is available as a choice and if the surgical team deems the procedure to be clean it can be entered as such into the NHSN application. For example CSEC, HYST, or OVRY can be a clean wound class if documented as such.
Wounds are divided into four classes:

1. **Clean:** An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow nonpenetrating (blunt) trauma should be included in this category if they meet the criteria.

   Note: The clean wound classification level will not be available for denominator data entry for the following NHSN operative procedure categories: APPY, BILI, CHOL, COLO, REC, SB, and VHYS

2. **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.

3. **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 including necrotic tissue without evidence of purulent drainage (e.g., dry gangrene) are included in this category.

4. **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.

Table 2. Surgical Site Infection Criteria

Criterion	Surgical Site Infection (SSI)
	Superficial incisional SSI Must meet the following criteria:
	Infection occurs within 30 days after any NHSN operative procedure (where day 1 = the procedure date), including those coded as 'OTH'***** **AND** involves only skin and subcutaneous tissue of the incision **AND** patient has at least ***one*** of the following: a. purulent drainage from the superficial incision. b. organisms isolated from an aseptically-obtained culture from the superficial incision or subcutaneous tissue. c. superficial incision that is deliberately opened by a surgeon, attending physician** or other designee and is culture positive or not cultured **AND** patient has at least ***one*** of the following signs or symptoms: pain or tenderness; localized swelling; erythema; or heat. A culture negative finding does not meet this criterion. d. diagnosis of a superficial incisional SSI by the surgeon or attending physician** or other designee. *****http://www.cdc.gov/nhsn/XLS/ICD-9-cmCODEScurrent.xlsx ** The term attending physician for the purposes of application of the NHSN SSI criteria may be interpreted to mean the surgeon(s), infectious disease, other physician on the case, emergency physician or physician's designee (nurse practitioner or physician's assistant).
Comments	There are two specific types of superficial incisional SSIs: 1. Superficial Incisional Primary (SIP) – a superficial incisional SSI that is identified in the primary incision in a patient that has had an operation with one or more incisions (e.g., C-section incision or chest incision for CBGB) 2. Superficial Incisional Secondary (SIS) – a superficial incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CBGB)
Reporting Instructions for Superficial SSI	**The following do not qualify as criteria for meeting the NHSN definition of superficial SSI:** • Diagnosis/treatment of cellulitis (redness/warmth/swelling), by itself, does not meet criterion d for superficial incisional SSI. An incision that is draining or culture (+) is not considered a cellulitis.

Criterion	Surgical Site Infection (SSI)
	• A stitch abscess alone (minimal inflammation and discharge confined to the points of suture penetration) • A localized stab wound or pin site infection. While it would be considered either a skin (SKIN) or soft tissue (ST) infection, depending on its depth, it is not reportable under this module. **Note:** a laparoscopic trocar site for an NHSN operative procedure is not considered a stab wound. • Circumcision is not an NHSN operative procedure. An infected circumcision site in newborns is classified as CIRC and is not reportable under this module. • An infected burn wound is classified as BURN and is not reportable under this module.
	Deep incisional SSI Must meet the following criteria:
	Infection occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date) according to the list in Table 3 **AND** involves deep soft tissues of the incision (e.g., fascial and muscle layers) **AND** patient has at least ***one*** of the following: a. purulent drainage from the deep incision. b. a deep incision that spontaneously dehisces, or is deliberately opened or aspirated by a surgeon, attending physician** or other designee and is culture positive or not cultured **AND** patient has at least ***one*** of the following signs or symptoms: fever (>38°C); localized pain or tenderness. A culture negative finding does not meet this criterion. c. an abscess or other evidence of infection involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging test. ** The term attending physician for the purposes of application of the NHSN SSI criteria may be interpreted to mean the surgeon(s), infectious disease, other physician on the case, emergency physician or physician's designee (nurse practitioner or physician's assistant).
Comments	There are two specific types of deep incisional SSIs: 1. Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., C-section incision or chest incision for CBGB) 2. Deep Incisional Secondary (DIS) – a deep incisional SSI that is

Criterion	Surgical Site Infection (SSI)
	identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CBGB)
	Organ/Space SSI Must meet the following criteria:
	Infection occurs within 30 or 90 days after the NHSN operative procedure (where day 1 = the procedure date) according to the list in Table 3 **AND** infection involves any part of the body deeper than the fascial/muscle layers, that is opened or manipulated during the operative procedure **AND** patient has at least ***one*** of the following: a. purulent drainage from a drain that is placed into the organ/space (e.g., closed suction drainage system, open drain, T-tube drain, CT guided drainage) b. organisms isolated from an aseptically-obtained culture of fluid or tissue in the organ/space c. an abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test **AND** meets at least ***one*** criterion for a specific organ/space infection site listed in Table 4. These criteria are in the Surveillance Definitions for Specific Types of Infections chapter.

Table 3. Surveillance Period for Deep Incisional or Organ/Space SSI Following Selected NHSN Operative Procedure Categories. Day 1 = the date of the procedure.

30-day Surveillance			
Code	**Operative Procedure**	**Code**	**Operative Procedure**
AAA	Abdominal aortic aneurysm repair	LAM	Laminectomy
AMP	Limb amputation	LTP	Liver transplant
APPY	Appendix surgery	NECK	Neck surgery
AVSD	Shunt for dialysis	NEPH	Kidney surgery
BILI	Bile duct, liver or pancreatic surgery	OVRY	Ovarian surgery
CEA	Carotid endarterectomy	PRST	Prostate surgery
CHOL	Gallbladder surgery	REC	Rectal surgery
COLO	Colon surgery	SB	Small bowel surgery
CSEC	Cesarean section	SPLE	Spleen surgery
GAST	Gastric surgery	THOR	Thoracic surgery
HTP	Heart transplant	THYR	Thyroid and/or parathyroid surgery
HYST	Abdominal hysterectomy	VHYS	Vaginal hysterectomy
KTP	Kidney transplant	XLAP	Exploratory Laparotomy
		OTH	Other NHSN operative procedures not included in these categories

90-day Surveillance	
Code	**Operative Procedure**
BRST	Breast surgery
CARD	Cardiac surgery
CBGB	Coronary artery bypass graft with both chest and donor site incisions
CBGC	Coronary artery bypass graft with chest incision only
CRAN	Craniotomy
FUSN	Spinal fusion
FX	Open reduction of fracture
HER	Herniorrhaphy
HPRO	Hip prosthesis
KPRO	Knee prosthesis
PACE	Pacemaker surgery
PVBY	Peripheral vascular bypass surgery
RFUSN	Refusion of spine
VSHN	Ventricular shunt

Note: Superficial incisional SSIs are only followed for a 30-day period for all procedure types.

Table 4. Specific Sites of an Organ/Space SSI.

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

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

Numerator Data: All patients having any of the procedures included in the selected NHSN operative procedure category(s) are monitored for signs of SSI. The *Surgical Site Infection (SSI)* form is completed for each such patient found to have an SSI. If no SSI events are identified during the surveillance month, check the "Report No Events" field in the Missing PA Events tab of the Incomplete/Missing List.

The Instructions for Completion of the Surgical Site Infection form include brief instructions for collection and entry of each data element on the form. The SSI form includes patient demographic information and information about the operative procedure, including the date and type of procedure. Information about the SSI includes the date of SSI, specific criteria met for identifying the SSI, when/how the SSI was detected, whether the patient developed a secondary bloodstream infection, whether the patient died, and the organisms isolated from cultures and the organisms' antimicrobial susceptibilities.

SSI Event Reporting Instructions:

1. **Attributing SSI to an NHSN procedure when there is evidence of infection at the time of the primary surgery:** POA definition does not apply to the SSI protocol. If there was evidence of infection at the time of the procedure and then later in the surveillance period the patient develops an infection that meets the NHSN SSI criteria it is attributed to the procedure (see PATOS below). A high wound class is not exclusion for a patient later meeting criteria for an SSI.

2. **Infection present at time of surgery (PATOS):** PATOS denotes that there is evidence of an infection or abscess at the start of or during the index surgical procedure (in other words, it is present preoperatively). PATOS is a YES/NO field on the SSI Event form. PATOS does not apply if there is a period of wellness between the time of a preoperative condition and surgery. The evidence of infection or abscess must be noted/documented preoperatively or found intraoperatively in a pre-operative or intraoperative note. Only select PATOS = YES if it applies to the depth of SSI that is being attributed to the procedures (e.g., if a patient had evidence of an intraabdominal infection at the time of surgery and then later return with an organ space SSI the PATOS field would be selected as a YES. If the patient returned with a superficial or deep incisional SSI the PATOS field would be selected as a NO). The patient does not have to meet the NHSN definition of an SSI at the time of the primary procedure but there must be notation that there is evidence of an infection or abscess present at the time of surgery.

    a) **Example:** Patient admitted with an acute abdomen. Sent to OR for an XLAP where there is a finding of an abscess due to ruptured appendix and an APPY is performed. Patient returns two weeks later and meets criteria for an organ space IAB SSI. The PATOS field would be selected as YES on the SSI event.

    b) **Example:** Patient is admitted with a ruptured diverticulum. In the OR note the surgeon documents that there are multiple abscesses in the intraabdominal cavity. Patient returns three weeks later and meets criteria for a superficial SSI. The PATOS field would be selected as NO since there was no documentation of evidence of infection or abscess of the superficial area at the time of the procedure.

    c) **Example:** During an unplanned cesarean section (CSEC) the surgeon nicks the bowel and there is contamination of the intraabdominal cavity. One week later the patient returns and meets criteria for an organ space OREP (other reproductive) SSI. The PATOS field would be selected as NO since there was no documentation of evidence of infection or abscess at the time of the CSEC. The colon nick was a complication but there was no infection present at the time of surgery.

3. **Multiple tissue levels are involved in the infection:** The type of SSI (superficial incisional, deep incisional, or organ/space) reported should reflect the deepest tissue layer involved in the infection during the surveillance period:
    a) Report infection that involves the organ/space as an organ/space SSI, whether or not it also involves the superficial or deep incision sites.
    b) Report infection that involves the superficial and deep incisional sites as a deep incisional SSI.
    c) If an SSI started as a superficial SSI on day 10 of the SSI surveillance period and then a week later, (day 17 of the SSI surveillance period) meets criteria for a deep incisional SSI the date of event would be the date the of deep incisional SSI.

4. **Reporting of SSI after a non-primary closure:** If a patient develops an SSI after a non-primary closure it should be reported as attributable to that procedure if it meets criteria for an SSI within the surveillance period.

5. **Attributing SSI to a NHSN procedure when several are performed on different dates:** If a patient has several NHSN operative procedures performed on different dates 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 was associated with a different operation.
    Note: for multiple NHSN operative procedures performed within a 24 hour period, see Denominator Reporting Instruction #9.

6. **Attributing SSI to NHSN procedures that involve multiple primary incision sites:** If multiple primary incision sites of the same NHSN operative procedure become infected, only report as a single SSI, and assign the type of SSI (superficial incisional, deep incisional, or organ/space) that represents the deepest tissue level involved at any of the infected sites. For example:
    a) If one laparoscopic incision meets criteria for a superficial incisional SSI and another meets criteria for a deep incisional SSI, only report one deep incisional SSI.
    b) If one or more laparoscopic incision sites meet criteria for superficial incisional SSI but the patient also has an organ/space SSI related to the laparoscopic procedure, only report one organ/space SSI.
    c) If an operative procedure is limited to a single breast and involves multiple incisions in that breast that become infected, only report a single SSI.
    d) In a colostomy formation or reversal (take down) procedure, the stoma and other abdominal incision sites are considered primary incisions. If both the stoma and another abdominal incision site develop superficial incisional SSI, report only as one SSI (SIP).

7. **Attributing SSI to NHSN procedures that have secondary incision sites**: Certain procedures can involve secondary incisions (i.e., BRST, CBGB, CEA, FUSN, PVBY, REC, RFUSN, and VSHN). The surveillance period for all secondary sites is 30 days, regardless of the required deep incisional or organ/space SSI surveillance period for the

primary incision site(s) (Table 3). Procedures meeting this designation are reported as only one operative procedure. For example:

a) A saphenous vein harvest incision site in a CBGB procedure is considered the secondary incision. One CBGB procedure is reported, the saphenous vein harvest site is monitored for 30 days after surgery for SSI, and the chest incision is monitored for 90 days. If the patient has a superficial infection of the leg site and a deep incisional SSI of the chest site two SSIs are reported.
b) A tissue harvest site (e.g., Transverse Rectus Abdominis Myocutaneous [TRAM] flap) in a BRST procedure is considered the secondary incision site. One BRST procedure is reported, and if the secondary incision gets infected, report as either SIS or DIS as appropriate.

8. **SSI detected at another facility:** It is required that if an SSI is detected at a facility other than the one in which the operation was performed, notify the IP of the index facility with enough detail so the infection can be reported to NHSN. When reporting the SSI, the index facility should indicate that Detected = RO – (Readmission to facility other than where procedure was performed).

9. **SSI Attribution after Multiple types of NHSN procedures are performed during a single trip to the OR:** If more than one NHSN operative procedure category was performed through a single incision/laparoscopic sites during a single trip to the operating room, attribute the SSI to the procedure that is thought to be associated with the infection. If it is not clear, as is often the case when the infection is an incisional SSI, use the NHSN Principal Operative Procedure Category Selection Lists (Table 5) to select the operative procedure to which the SSI should be attributed. For example, if a patient develops SSI after a single trip to the OR in which both a COLO and SB were performed, and the source of the SSI is not apparent, assign the SSI to the COLO procedure.

10. **SSI following invasive manipulation/accession of the operative site:** If during the post-operative period the surgical site has an invasive manipulation/accession for diagnostic or therapeutic purposes (e.g., needle aspiration), and following this manipulation/accession an SSI develops, the infection is not attributed to the operation. This reporting instruction does NOT apply to closed manipulation (e.g., closed reduction of a dislocated hip after an orthopedic procedure). Invasive manipulation does not include wound packing, or changing of wound packing materials as part of postoperative care.

11. **Reporting instructions for specific post-operative infection scenarios:** An SSI that otherwise meets the NHSN definitions should be reported to NHSN without regard to post-operative accidents, falls, inappropriate showering or bathing practices, or other occurrences that may or may not be attributable to patients' intentional or unintentional postoperative actions. Also, SSI should also be reported regardless of the presence of certain skin conditions (e.g., dermatitis, blister, impetigo) that occur near an incision, and regardless of the possible occurrence of a "seeding" event from an unrelated procedure (e.g., dental work). This instruction concerning various postoperative circumstances is

necessary to reduce subjectivity and data collection burden associated with the previously exempted scenarios.

Table 5. NHSN Principal Operative Procedure Category Selection Lists
(The following lists are derived from the operative procedures listed in Table 1. The categories with the highest risk of SSI are listed before those with lower risks).

Priority	Code	Abdominal Operations
1	LTP	Liver transplant
2	COLO	Colon surgery
3	BILI	Bile duct, liver or pancreatic surgery
4	SB	Small bowel surgery
5	REC	Rectal surgery
6	KTP	Kidney transplant
7	GAST	Gastric surgery
8	AAA	Abdominal aortic aneurysm repair
9	HYST	Abdominal hysterectomy
10	CSEC	Cesarean section
11	XLAP	Laparotomy
12	APPY	Appendix surgery
13	HER	Herniorrhaphy
14	NEPH	Kidney surgery
15	VHYS	Vaginal Hysterectomy
16	SPLE	Spleen surgery
17	CHOL	Gall bladder surgery
18	OVRY	Ovarian surgery
Priority	**Code**	**Thoracic Operations**
1	HTP	Heart transplant
2	CBGB	Coronary artery bypass graft with donor incision(s)
3	CBGC	Coronary artery bypass graft, chest incision only
4	CARD	Cardiac surgery
5	THOR	Thoracic surgery
Priority	**Code**	**Neurosurgical (Brain/Spine) Operations**
1	VSHN	Ventricular shunt
2	RFUSN	Refusion of spine
3	CRAN	Craniotomy
4	FUSN	Spinal fusion
5	LAM	Laminectomy
Priority	**Code**	**Neck Operations**
1	NECK	Neck surgery
2	THYR	Thyroid and or parathyroid surgery

Denominator Data: For all patients having any of the procedures included in the NHSN Operative Procedure category(s) selected for surveillance during the month, complete the *Denominator for Procedure* form. The data are collected individually for each operative procedure performed during the month specified on the *Patient Safety Monthly Reporting Plan*. The Instructions for Completion of the Denominator for Procedure Form include brief instructions for collection and entry of each data element on the form.

Denominator Reporting Instructions:

1. **Closure type**: Incisional closure is NOT a part of the NHSN operative procedure definition; all otherwise eligible procedures are included in the denominator reporting, regardless of closure type. The closure technique is entered for each denominator for procedure. If a procedure has multiple incision sites and any of the incisions are closed primarily then the procedure is entered as a primary closure.
   Note: When the patient returns to the OR within 24 hours of the end of the first procedure assign the surgical wound closure that applies when the patient leaves the OR from the first operative procedure.

2. **Wound class**: A high wound class is not exclusion for denominator reporting. If the procedure meets the definition of an NHSN operative procedure it should be reported in the denominator data regardless of wound class. NHSN will use the wound class for risk adjustment, as appropriate.

3. **Different operative procedure categories performed during same trip to the OR:** If procedures in more than one NHSN operative procedure category are performed during the same trip to the operating room through the same or different incisions, a *Denominator for Procedure* form is reported for each NHSN operative procedure category being monitored. For example, if a CARD and CBGC are done through the same incision, a *Denominator for Procedure* form is reported for each. In another example, if following a motor vehicle accident, a patient has an open reduction of fracture (FX) and splenectomy (SPLE) performed during the same trip to the operating room and both procedure categories are being monitored, complete a *Denominator for Procedure* form for each.

   EXCEPTION: If a patient has both a CBGC and CBGB during the same trip to the operating room, report only as a CBGB. Only report as a CBGC if there is only a chest incision. CBGB and CBGC are never reported for the same patient for the same trip to the operating room.

4. **Duration of the procedure when more than one category of NHSN operative procedure is performed through the same incision:** If more than one NHSN operative procedure category is performed through the same incision during the same trip to the operating room, record the combined duration of all procedures, which is the time from procedure/surgery start time to procedure/surgery finish time. For example, if a CBGC and

a CARD are performed on a patient during the same trip to the operating room, the time from start time to finish time is reported for both operative procedures.

5. **Duration of Operative procedures if patient has two different NHSN operative procedures performed via separate incisions on the same trip to the OR;** try to determine the correct duration for each separate procedure (if this is documented), otherwise, take the time for both procedures and split it evenly between the two.

6. **Same operative procedure category but different ICD-9-CM codes during same trip to the OR:** If procedures of different ICD-9-CM codes from the same NHSN operative procedure category are performed through the same incision/laparoscopic sites, record only one procedure for that category. For example, a facility is performing surveillance for CARD procedures. A patient undergoes a replacement of both the mitral and tricuspid valves (35.23 and 35.27, both CARD) during the same trip to the operating room. Complete one CARD *Denominator for Procedure* form because ICD-9-CM codes 35.23 and 35.27 fall in the same operative procedure category [CARD] (see Table 1).

7. **For revision HPRO and KPRO procedures:** If total or partial revision HPRO or KPRO is performed, also evaluate if any of the following ICD-9-CM diagnosis or procedure codes (below) were coded in the 90 days prior to and including the index HPRO or KPRO revision. If any of the specified codes is recorded, indicate that the revision was associated with 'prior infection at index joint.' Note that the 'prior infection at index joint' variable only applies to *revision* HPRO and KPRO. Additionally, it is not necessary to review the medical record for additional details concerning the prior infection; this variable is defined by the presence of one or more of the following ICD-9-CM codes in the 90-day preoperative (including index revision) period:
   - 84.56 Insertion or replacement of (cement) spacer
   - 84.57 Removal of (cement) spacer
   - V88.21 Acquired absence of hip joint, with or without the presence of an antibiotic-impregnated spacer
   - V88.22 Acquired absence of knee joint, with or without the presence of an antibiotic-impregnated spacer

   - Complications peculiar to certain specified procedures, infection and inflammatory reaction due to internal prosthetic device, implant and graft (extensions of 996, 996.6):
     - 996.60 Due to unspecified device, implant and graft
     - 996.66 Due to internal joint prosthesis
     - 996.67 Due to other internal orthopedic device, implant, and graft
     - 996.69 Due to other internal prosthetic device, implant, and graft

8. **Same NHSN operative procedure via separate incisions:** For operative procedures that can be performed via separate incisions during same trip to operating room (i.e., AMP, BRST, CEA, FUSN, FX, HER, HPRO, KPRO, LAM, NEPH, OVRY, PVBY, REFUSN), separate *Denominator for Procedure* forms are completed. To document the duration of

the procedures, indicate the procedure/surgery start time to procedure/surgery finish time for each procedure separately or, alternatively, take the total time for the procedures and split it evenly between procedures.

Note: Laparoscopic hernia repairs are considered one procedure, regardless of the number of hernias that are repaired in that trip to the OR. In most cases there will be only one incision time documented for this procedure. If more than one time is documented, total the durations. Open (i.e., non-laparoscopic) hernia repairs are reported as one procedure for each hernia repaired via a separate incision, (i.e., if two incisions are made to repair two defects), then two procedures will be reported. It is anticipated that separate incision times will be recorded for these procedures. If not, take the total time for both procedures and split it evenly between the two.

9. **More than one operative procedure through same incision within 24 hours:** If a patient goes to the operating room more than once during the same admission and another procedure of the same or different NHSN procedure category is performed through the same incision and the start time of the second procedure is within 24 hours of the finish time of the original operative incision, report only one *Denominator for Procedure* form for the original procedure, combining the durations for both procedures based on the procedure start times and finish times for both procedures. For example, a patient has a CBGB lasting 4 hours. He returns to the OR six hours later to correct a bleeding vessel (OTH). The second operation has duration of 1.5 hours. Record the operative procedure as one CBGB and the duration of operation as 5 hour 30 minutes. If the wound class has changed, report the higher wound class. If the ASA class has changed, report the higher ASA class. Do not report the 'OTH' procedure.

   Note: When the patient returns to the OR within 24 hours of the end of the first procedure assign the surgical wound closure technique that applies when the patient leaves the OR from the first operative procedure.

10. **Patient expires in the OR:** If a patient expires in the operating room, do not complete a *Denominator for Procedure* form. This operative procedure is excluded from the denominator.

11. **Laparoscopic hysterectomy – HYST or VHYS:** When assigning the correct ICD-9-CM hysterectomy procedure code, a trained coder must determine what structures were detached and how they were detached based on the medical record documentation. The code assignment is based on the surgical technique or approach used for the detachment of those structures, not on the location of where the structures were physically removed from the patient's body.

Data Analyses: The Standardized Infection Ratio (SIR) is calculated by dividing the number of observed infections by the number of predicted (i.e., expected) infections. The number of predicted infections is calculated using SSI probabilities estimated from multivariate logistic regression models constructed from NHSN data during a baseline time period, which represents a standard population's SSI experience[4].

There are three SSI SIR models available from NHSN, each briefly described in the table below.

All SSI SIR Model	• Includes Superficial, Deep & Organ/Space SSIs • Superficial & Deep incisional SSIs limited to primary incisional SSIs only • Includes SSIs identified on admission, readmission & via post-discharge surveillance
Complex A/R SSI Model	• Includes only Deep incisional primary SSIs & Organ/Space SSIs • Includes only SSIs identified on Admission/Readmission to facility where procedure was performed • Includes only inpatient procedures • Used for the HAI Progress Report, published annually by CDC
Complex 30-day SSI model (used for CMS IPPS)	• Includes only in-plan, inpatient COLO and HYST procedures in adult patients (i.e., ≥ 18 years of age) • Includes only deep incisional primary SSIs and organ/space SSIs with an event date within 30 days of the procedure • Uses only age and ASA to determine risk • Used only for CMS IPPS reporting and for public reporting on Hospital Compare

While the SSI SIR can be calculated for single procedure categories and for specific surgeons, the measure also allows you to summarize your data across multiple procedure categories while adjusting for differences in the estimated probability of infection among the patients included across the procedure categories. For example, you will be able to obtain one SSI SIR adjusting for all procedures reported. Alternatively, you can obtain one SSI SIR for all colon surgeries (COLO) only within your facility.

Additional Notes about SSI SIRS:

1. **Primary closure:** All of the SSI SIRs that use the 2006-2008 SSI baseline data will include only those procedures that were reported with a primary closure method.[3]
2. **Infection present at time of surgery (PATOS):** All of the SSI SIRs that use the 2006-2008 SSI baseline will include SSIs that are reported as present at time of surgery.
3. **SIRs based on Procedure Date:** SSIs will be included in the numerator of an SIR based on the date of procedure, not the date of event.

4. **Calculation of the SIR:** The SIR will be calculated only if the number of predicted HAIs ("numExp" in the NHSN application) is ≥ 1 to help enforce a minimum precision criterion.

$$SIR = \frac{\text{Observed (O) HAIs}}{\text{Expected (E) HAIs}}$$

SSI rates per 100 operative procedures are calculated by dividing the number of SSIs by the number of specific operative procedures and multiplying the results by 100. SSIs will be included in the numerator of a rate based on the date of procedure, not the date of event. Using the advanced analysis feature of the NHSN application, SSI rate calculations can be performed separately for the different types of operative procedures and stratified by the basic risk index.

Descriptive analysis options of numerator and denominator data are available in the NHSN application, such as line listings, frequency tables, and bar and pie charts. SIRs and SSI rates and run charts are also available. Guides on using NHSN analysis features are available from: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html

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