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

Introduction: In 2002, an estimated 250,000 healthcare-associated pneumonias developed in U.S. hospitals and 36,000 of these were associated with deaths.[1] Patients with mechanically-assisted ventilation have a high risk of developing healthcare-associated pneumonia. For the year 2012, NHSN facilities reported more than 3,957 VAPs and the incidence for various types of hospital units ranged from 0.0-4.4 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 will occur in any inpatient pediatric location where denominator data can be collected, which may include critical/intensive care units (PICUs), specialty care areas (SCA), step-down units, wards, and long term care units. In 2015, in-plan surveillance for ventilator-associated pneumonia (PNEU) using the criteria found in this chapter will be restricted to patients of any age in pediatric 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, pediatricor neonatal patients. 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 PNEU /VAP after the patient is discharged from the facility. However, if discovered, any PNEU /VAP with event date on the day of discharge or the next day should be reported to NHSN if you are following (PedVAP) in your monthly reporting plan. (see Transfer Rule below). No additional ventilator days are reported.

Requirements: For in-plan reporting surveillance for PedVAP will occur in at least one inpatient pediatric location in the healthcare institution for at least one calendar month as indicated in the *Patient Safety Monthly Reporting Plan* (CDC 57.106).

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.

POA reporting exception for PNEU/VAP: If all other elements are present per the POA criteria, one chest radiograph alone 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.

How to Apply HAI Definition to the PNEU/VAP Protocol:

A serial chest radiograph (CXR) on or after day 3 of admission (HAI) and a second later CXR may be used to meet the radiology finding requirement in a patient with underlying disease. The second CXR must occur within 7 days of the first. These findings can be used to fulfill the current HAI PNEU/VAP criteria for the required 2 CXR findings are considered 1 element of the PNEU/VAP criteria. All other elements of PNEU/VAP should be met per the HAI definition. The PNEU/VAP HAI criteria are met even if all other elements required for PNEU/VAP are not present at the time the second CXR is obtained.

Pneumonia (PNEU) is identified by using a combination of radiologic, 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 2-5 and Figures 1 and 2), general comments applicable to all specific site criteria, and reporting instructions. Table 6 shows threshold values for cultured specimens used in the surveillance diagnosis of pneumonia.

Date of event: For PNEU/VAP the date of event is the date when the first element used to meet the Pneumonia (PNEU) criteria occurred. Synonyms: infection date.

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 VAP event, which is further defined as the date when the last element used to meet the PNEU criterion occurred (see exception below).

EXCEPTION TO LOCATION OF ATTRIBUTION:

Transfer Rule: If all elements of a PNEU/VAP are present within 2 days of transfer from one inpatient location to another in the same facility or a new facility (i.e., on the day of transfer or the next day), the infection is attributed to the transferring location or facility. If the patient was in multiple locations within the transfer rule time frame, attribute the infection to the original location initiating the transfer. 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:

- Child has been on a ventilator for 7 days in the PICU and is transferred on the ventilator to the pediatric surgical ward. On the next day, the patient meets the criteria for PNEU. 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. Later that night, the child meets criteria for a PNEU. 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). After 4 days in the PICU, the patient meets the criteria for a PNEU. This is reported to NHSN as a VAP for the PICU.
- Pediatric patient on the Respiratory ICU (RICU) of Hospital A had the endotracheal tube and ventilator removed after being on the ventilator for 5 days 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 with a PNEU. This VAP should be reported to NHSN for, and by, Hospital A and attributed to the RICU. No additional ventilator days for the RICU are reported.

General comments applicable to all pneumonia specific site criteria:

1. Physician's diagnosis of pneumonia alone is not an acceptable criterion for healthcare-associated pneumonia.
2. Although specific criteria are included for infants and children and immunocompromised patients, all patients may meet any of the other pneumonia specific site criteria.
3. When assessing a patient for presence of pneumonia, it is important to distinguish between changes in clinical status due to other conditions such as myocardial infarction, pulmonary embolism, respiratory distress syndrome, atelectasis, malignancy, chronic obstructive pulmonary disease, hyaline membrane disease, bronchopulmonary dysplasia, etc. Also, care must be taken when assessing intubated patients to distinguish between tracheal colonization, upper respiratory

tract infections (e.g., tracheobronchitis), and early onset pneumonia. Finally, it should be recognized that it may be difficult to determine healthcare-associated pneumonia in the elderly, infants, and immunocompromised patients since such conditions may mask typical signs or symptoms associated with pneumonia. Alternate specific elements for the elderly, infants and immunocompromised patients have been included in this definition of healthcare-associated pneumonia.

4. Pneumonia due to gross aspiration (for example, in the setting of intubation in the field, emergencydepartment, or operating room) that does not meet NHSN POA definition is considered healthcare-associated if it meets any PNEU definition.
5. 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, see **Note** following HAI definition in Chapter 2. The addition of or change in pathogen alone is not indicative of a new episode of pneumonia.
6. . Excluded organisms that cannot be used to meet pneumonia definitions are as follows: results indicating isolation of oral cavity or upper respiratory tract flora (e.g., Normal Oral Flora, Mixed Oral Flora); 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:
ANY organism isolated from cultures of lung tissue or pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube), including Candida species or yeast not otherwise specified, coagulase-negative Staphylococcus species or Enterococcus species may be reported as pathogens for PNEU
EXCEPTION:*
Candida species or yeast not otherwise specified isolated from sputum or endotracheal aspirate specimen and blood culture can be used to satisfy the PNU3 definition.

Abbreviations
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. Even if a patient meets criteria for more than one specific site, 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.
- Report concurrent lower respiratory tract infection (e.g., abscess or empyema) and pneumonia with the same organism(s) as PNEU.
- Lung abscess or empyema without pneumonia is classified as LUNG.
- Secondary bloodstream infections can be reported for PNU1, PNU2 and PNU3 definition. Do not report any pneumonias (PNU1, PNU2, PNU3) where Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus or Pneumocystis. is found to be the causative agent of pneumonia.

Table 2: Specific Site Algorithms for Clinically Defined Pneumonia (PNU1)

<table>
<tr><th>Imaging Test Evidence</th><th>Signs/Symptoms/Laboratory</th></tr>
<tr><td rowspan="2">Two or more serial chest imaging test results with at least <u>one</u> of the following[1,2]:

• New or progressive <u>and</u> 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), <u>one</u> <u>definitive</u> imaging test result is acceptable.[1]</td><td>For ANY PATIENT, at least <u>one</u> 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

<u>and</u>
at least <u>two</u> of the following:

• New onset of purulent sputum[3] (refer to Table ?#) 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)</td></tr>
<tr><td>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)

<u>and</u>
at least <u>three</u> of the following:

• Temperature instability
• Leukopenia (<4000 WBC/mm^3) <u>or</u> leukocytosis (≥15,000 WBC/mm^3) and left shift (≥10% band forms)
• New onset of purulent sputum[3] (refer to Table ?) 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)</td></tr>
</table>

Imaging Test Evidence	Signs/Symptoms/Laboratory
	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] (refer to Table ?#) 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 3: 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] (refer to Table ?) 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 parenchyma
		• Histopathologic exam shows at least **one** of the following evidences of pneumonia:
		  ○ Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli
		  ○ Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae

Table 4: 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](refer to Table ?) 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[10, 11, 12]: • Positive culture of virus, *Legionella* or *Chlamydia* from respiratory secretions • Positive non culture diagnostic laboratory test of respiratory secretions or tissue for virus, *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. pneumo*phila 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 5: 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 [13]) 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 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) • Hemoptysis • Pleuritic chest pain	At least **one** of the following: • Matching positive blood and sputum or endotracheal aspirate cultures with *Candida* spp.[14,15] • Evidence of fungi or 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:

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 (for example, interstitial lung disease or congestive heart failure), the diagnosis of pneumonia may be particularly difficult. Other non-infectious conditions (for example, 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 imaging test results on the day of diagnosis, 3 days prior to the diagnosis and on days 2 and 7 after the diagnosis. Pneumonia may have rapid onset and progression, but does not resolve quickly. Imaging test evidence of

pneumonia persists for several weeks. As a result, 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. See Table?

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. A single notation of change in character of the sputum is not meaningful; repeated notations over a 24-hour period would be more indicative of the onset of an infectious process. 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 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 or yeast not otherwise specified and isolated from sputum or endotracheal aspirate specimen and blood culture can be used to satisfy the PNU3 definition.9. Refer to threshold values for cultured specimens (Table 6). A sputum and endotracheal aspirate are not minimally- *contaminated specimens and therefore,organisims 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 thoracentesisor intial 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 or yeast not otherwise specified can be used to meet the PNU3 specific laboratory criteria.

13. 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).

14. Blood and sputum or endotracheal aspirate specimens must satisfy gap day definition (see key terms) 15. Semiquantitative or non-quantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage a
specifi

Facility ID#_____**Event #**_____ **Event Date**

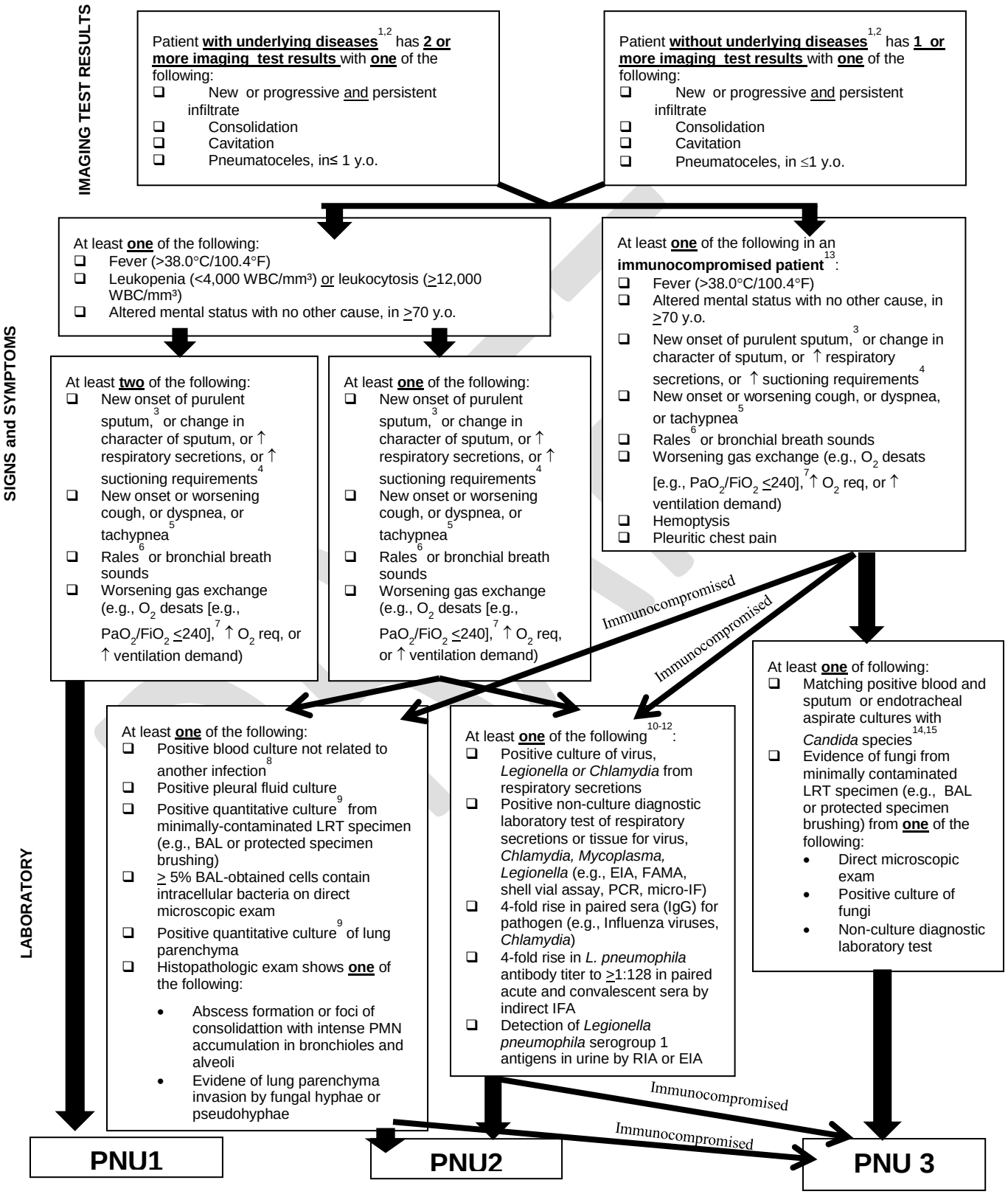
IMAGING TEST RESULTS
Patient with underlying diseases[1,2] has 2 or more imaging test results with one of the following:
❑ New or progressive and persistent infiltrate
❑ Consolidation
❑ Cavitation
❑ Pneumatoceles, in≤ 1 y.o.
Patient without underlying diseases[1,2] has 1 or more imaging test results with one of the following:
❑ New or progressive and persistent infiltrate
❑ Consolidation
❑ Cavitation
❑ Pneumatoceles, in ≤1 y.o.
SIGNS and SYMPTOMS
At least one of the following:
❑ Fever (>38.0°C/100.4°F)
❑ Leukopenia (<4,000 WBC/mm³) or leukocytosis (≥12,000 WBC/mm³)
❑ Altered mental status with no other cause, in ≥70 y.o.
At least two of the following:
❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
❑ Rales[6] or bronchial breath sounds
❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤240],[7] ↑ O_2 req, or ↑ ventilation demand)
At least one of the following:
❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
❑ Rales[6] or bronchial breath sounds
❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤240],[7] ↑ O_2 req, or ↑ ventilation demand)
At least one of the following in an immunocompromised patient[13]:
❑ Fever (>38.0°C/100.4°F)
❑ Altered mental status with no other cause, in ≥70 y.o.
❑ New onset of purulent sputum,[3] or change in character of sputum, or ↑ respiratory secretions, or ↑ suctioning requirements[4]
❑ New onset or worsening cough, or dyspnea, or tachypnea[5]
❑ Rales[6] or bronchial breath sounds
❑ Worsening gas exchange (e.g., O_2 desats [e.g., PaO_2/FiO_2 ≤240],[7] ↑ O_2 req, or ↑ ventilation demand)
❑ Hemoptysis
❑ Pleuritic chest pain
Immunocompromised
Immunocompromised
LABORATORY
At least one of the following:
❑ Positive blood culture not related to another infection[8]
❑ Positive pleural fluid culture
❑ 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
❑ Positive quantitative culture[9] of lung parenchyma
❑ Histopathologic exam shows one of the following:
• Abscess formation or foci of consolidattion with intense PMN accumulation in bronchioles and alveoli
• Evidene of lung parenchyma invasion by fungal hyphae or pseudohyphae
At least one of the following[10-12]:
❑ Positive culture of virus, *Legionella or Chlamydia* from respiratory secretions
❑ Positive non-culture diagnostic laboratory test of respiratory secretions or tissue for virus, *Chlamydia, Mycoplasma, Legionella* (e.g., EIA, FAMA, shell vial assay, PCR, micro-IF)
❑ 4-fold rise in paired sera (IgG) for pathogen (e.g., Influenza viruses, *Chlamydia*)
❑ 4-fold rise in *L. pneumophila* 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
At least one of following:
❑ Matching positive blood and sputum or endotracheal aspirate cultures with *Candida* species[14,15]
❑ 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
Immunocompromised
Immunocompromised
PNU1
PNU2
PNU 3

Figure 1: Pneumonia Flow Diagram, Alternative Criteria for Infants and Children

PNEUMONIA FLOW DIAGRAM
ALTERNATE CRITERIA FOR INFANTS AND CHILDREN

Facility ID #_____ Event #_____ Date of Event____/_____/_____

Instructions: Complete form only if x-ray criteria are met

X-Ray

Patient **with underlying diseases**[1,2] has **2 or more** imaging test results with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Patient **without underlying diseases**[1,2] **has 1 or more** imaging test results with **one** of the following:

- ❑ New or progressive and persistent infiltrate
- ❑ Consolidation
- ❑ Cavitation
- ❑ Pneumatoceles, in ≤1 y.o.

Signs and Symptoms

Infants ≤1 y.o.

- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., pulse oximetry <94%], ↑↑ O_2 req. or↑↑ ventilation demand)

↑

and **three** of the following:

- ❑ Temperature instability
- ❑ Leukopenia (<4,000 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 ↑↑respiratory secretions, or ↑↑suctioning requirements
- ❑ Apnea, tachypnea[5], nasal flaring with retraction of chest wall or grunting.
- ❑ Wheezing, rales[6], or rhonchi
- ❑ Cough
- ❑ Bradycardia (<100 beats/min) or tachycardia (>170 beats/min)

Children >1 or ≤12 y.o.

At least **three** of the following:

- ❑ Fever (>38.0°C/101.4°F) or hypothermia (<36.0°C/96.8°F)
- ❑ Leukopenia (<4,000 WBC/mm^3) or leukocytosis (≥15,000 WBC/mm^3)
- ❑ New onset of purulent sputum,[3] or change in character of sputum,[4] or↑↑ respiratory secretions, or ↑ suctioning requirements
- ❑ New onset of worsening cough, or dyspnea, apnea, or tachypnea[6]
- ❑ Rales[6] or bronchial breath sounds
- ❑ Worsening gas exchange (e.g., O_2 desats [e.g., pulse oximetry <94%], ↑↑ O_2 req. or↑↑ ventilation demand)

❑ **PNU1:**

Clinically-defined pneumonia

Table 6: Threshold values for cultured specimens used in the diagnosis of pneumonia

Specimen collection/technique	Values
Lung parenchyma*	$\geq 10^4$ 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

CFU = colony forming units
g = gram
ml = milliliter
* Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or transbronchial biopsy

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 3 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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[1]Klevens RM, Edward JR, Richards CL, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Reports 2007;122:160-166.

[2]Dudeck MA, Weiner LM, et al. National Healthcare Safety Network (NHSN) Report, Data Summary for 2012, Device-associated Module.

[3]Centers for Disease Control and Prevention. Guidelines for preventing health-care-associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. MMWR 2004;53(No. RR-3).

[4]Your guide to the Standardized Infection Ratio (SIR). October 2010. http://www.cdc.gov/nhsn/PDFs/Newsletters/NHSN_NL_OCT_2010SE_final.pdf

[5] Edwards JR, Peterson KD, Mu Y, et al. National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008, issued December 2009. Am J Infect Control 2009;37:783-805. Available at: http://www.cdc.gov/nhsn/PDFs/dataStat/2009NHSNReport.PDF.

Instructions for Completion of Pneumonia (PNEU) Form (CDC 57.111)

Data Field	Instructions for Data Collection
Facility ID	The NHSN-assigned facility ID will be auto entered by the computer.
Event #	Event ID number will be auto entered by the computer.
Patient ID	Required. Enter the alphanumeric patient ID number. This is the patient identifier assigned by the hospital and may consist of any combination of numbers and/or letters.
Social Security #	Optional. Enter the 9-digit numeric patient Social Security Number.
Secondary ID	Optional. Enter the alphanumeric ID number assigned by the facility.
Medicare #	Optional. Enter the patient's Medicare number.
Patient name	Optional. Enter the last, first, and middle name of the patient.
Gender	Required. Check Female, Male, or Other to indicate the gender of the patient.
Date of birth	Required. Record the date of the patient birth using this format: MM/DD/YYYY.
Ethnicity	Optional. Specify if the patient is either Hispanic or Latino, or Not Hispanic or Not Latino.
Race	Optional. Specify one or more of the choices below to identify the patient's race: American Indian/Alaska Native Asian Black or African American Native Hawaiian/Other Pacific Islander White
Event type	Required. PNEU.
Date of event	Required. The date of event is the date when the first element used to meet the CDC/NHSN site-specific infection criterion occurred. Synonyms: infection date, date of infection. Enter date of this event using this format: MM/DD/YYYY. **NOTE:** If a device has been pulled on the first day of the month in a location where there are no other device days in that month, and a device-associated infection develops after the device is pulled, attribute the infection to the previous month.
Post-procedure PNEU	Optional. Check Y if this event occurred after an NHSN- defined procedure but before discharge from the facility, otherwise check N.
Date of procedure	Conditionally required. If Post-procedure PNEU = Y, then enter the date the procedure was done.

NHSN procedure code	Conditionally required. Answer this question only if this patient developed the PNEU during the same admission as an operative procedure. Enter the appropriate NHSN procedure code. **NOTE:** A PNEU cannot be "linked" to an operative procedure unless that procedure has already been added to NHSN. If the procedure was previously added, and the "Link to Procedure" button is clicked, the fields pertaining to the operation will be auto entered.
ICD-9-CM procedure code	Optional. The ICD-9-CM code may be entered here instead of (or in addition to) the NHSN Procedure Code. If the ICD-9-CM code is entered, the NHSN code will be auto entered by the computer. If the NHSN code is entered first, you will have the option to select the appropriate ICD-9-CM code. In either case, it is optional to select the ICD-9-CM code. Only those ICD-9-CM codes identified in Table 1 of the Surgical Site Infection Event Chapter (Chapter 9 of NHSN Manual: Patient Safety Component Protocol) are allowed.
MDRO Infection Surveillance	Required. Enter "Yes", if the pathogen is being followed for Infection Surveillance in the MDRO/CDI Module in that location as part of your Monthly Reporting Plan: MRSA, MSSA (MRSA/MSSA), VRE, CephR-*Klebsiella*, CRE-E. coli, CRE-Enterobacter ,CRE-*Klebsiella*, MDR-*Acinetobacter* or *C. difficile*. If the pathogen for this infection happens to be an MDRO but your facility is not following the Infection Surveillance in the MDRO/CDI Module in your Monthly Reporting Plan, answer "No" to this question.
Location	Required. Enter the inpatient location to which the patient was assigned when the last element used to meet the PNEU infection criterion occurred. If the PNEU develops in a patient within 2 calendar days of transfer (i.e. day of transfer or next day) from a location, indicate the transferring location, not the current location of the patient; day of transfer counts as Day 1
Date admitted to facility	Required. Enter date patient admitted to facility using this format: MM/DD/YYYY. An NHSN Inpatient is defined as a patient whose date of admission to the healthcare facility and the date of discharge are different calendar days. When determining a patient's admission dates to both the facility and specific inpatient location, the NHSN user must take into account all such days, including any days spent in an inpatient location as an "observation" patient before being officially admitted as an inpatient to the facility, as these days contribute to exposure risk. Therefore, all such days are included in the counts of admissions and patient days for the facility and specific location, and facility and admission dates must be moved back to the first day spent in the inpatient location.

	NOTE- Recently Discharged Patients: If a previously unreported VAP is identified on the day of discharge or the day after discharge, enter the previous date of admission.
Risk Factors Ventilator Birth weight	Required. Check Y if the patient with PNEU had a device to assist or control respiration through a tracheostomy or by endotracheal intubation, inclusive of the weaning period, for >2 calendar days when the first element of the PNEU criteria was present (date of event) and the device must have been in place on the date of the event or the day before., otherwise check N. Date of device insertion = Day 1. Optional. For *off-plan* reporting in a NICU patient, enter the patient's birth weight in grams, <u>not</u> the weight on the date of event.
Location of device insertion	Optional. Enter the patient location where the intubation and ventilation procedure was performed
Date of device insertion	Optional. Enter the date the intubation and ventilation procedure was performed.
Event Details: PNEU Specific event	Required. Check one: Clinically Defined Pneumonia (PNU1), Pneumonia with specific laboratory findings (PNU2), or Pneumonia in immunocompromised patients (PNU3), whichever criteria are met for this event.
Event Details: Specify criteria used	Required. Check each of the elements that were met.
Event Details: Secondary bloodstream infection	Required. Check Y if there is a culture-confirmed bloodstream infection (BSI) and a related pneumonia, otherwise check N. **NOTE:** 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.
Event Details: Died	Required. Check Y if patient died during the hospitalization, otherwise check N.
Event Details: PNEU contributed to death	Conditionally required. If the patient died, check Y if the PNEU contributed to death, otherwise check N.
Event Details: Discharge date	Optional. Date patient discharged from facility.
Event Details:	Required. Enter Y if Pathogen Identified, N otherwise; if Yes,

Pathogen identified	specify on reverse.
Pathogen # for specified Gram-positive Organisms, Gram-negative Organisms, Fungal Organisms, or Other Organisms	Up to three pathogens may be reported. If multiple pathogens are identified, enter the pathogen judged to be the most important cause of infection as #1, the next most as #2, and the least as #3 (usually this order will be indicated on the laboratory report). If the species is not given on the lab report or is not found on the NHSN organism list, then select the "spp" choice for the genus (e.g., *Bacillus natto* is not on the list so would be reported as *Bacillus* spp.).
Antimicrobial agent and susceptibility results	Conditionally required if Pathogen Identified = Y. • For those organisms shown on the back of an event form, susceptibility results are required only for the agents listed. • For organisms that are not listed on the back of an event form, the entry of susceptibility results is optional. Circle the pathogen's susceptibility result using the codes on the event forms. Additional antimicrobial agents and susceptibility results may be reported for up to a total of 20 agents.
Custom Fields	Optional. Up to 50 fields may be customized for local or group use in any combination of the following formats: date (MM/DD/YYYY), numeric, or alphanumeric. **Note:** Each Custom Field must be set up in the Facility/Custom Options section of the application before the field can be selected for use.
Comments	Optional. Enter any information on the event.