TENNESSEE DEPARTMENT OF HEALTH
HEALTHCARE-ASSOCIATED INFECTIONS AND ANTIMICROBIAL RESISTANCE PROGRAM
Surveillance Definitions

PNEUMONIA 3 (PNEU3)

(Last updated June, 2011)

Pneumonia (PNEU) is identified by using a combination of radiologic, clinical and laboratory criteria. Report PNEUs that are ventilator-associated (i.e., patient was intubated and ventilated at the time of or within 48 hours before the onset of the event).

> **NOTE:** There is no minimal period of time that the ventilator must be in place in order for the PNEU to be considered ventilator-associated.

Primary vs. secondary attribution: Because a fever is a non-specific sign of infection, it is possible that an individual may run a fever due to more than one infection at a time. It would be impossible to determine which infection (if not both) was the cause of the fever. Therefore, if all other criteria besides fever are met, both infections would be reported if surveillance for both of these events were being performed.

Source: NHSN September 2011 Newsletter
URL: www.cdc.gov/nhsn/PDFs/Newsletters/newsletter-Sept-2011.pdf

> **NOTE:** Although CDC provided interpretive guidance related to primary vs. secondary attribution in the September NHSN Newsletter, TDH has asked that IPs apply this interpretive guidance starting January 2011 to ensure a full calendar year of comparable data.

Location of attribution: The inpatient location where the patient was assigned on the date of the PNEU event, which is further defined as the date when the first clinical evidence appeared or the date the specimen used to meet the PNEU criterion was collected, whichever came first.

EXAMPLE: Patient is intubated and ventilated in the Operating Room and then is admitted to the MICU. Within 24 hours of admission to the MICU, patient meets criteria for PNEU. This is reported to NHSN as VAP for the MICU, because the Operating Room is not an inpatient location and no denominator data are collected there.

TRANSFER RULE EXCEPTION: If a VAP develops within 48 hours of transfer from one inpatient location to another in the same facility, the infection is attributed to the transferring location. This is called the Transfer Rule and examples are shown below:

- Patient on a ventilator in the SICU is transferred to the surgical ward. Thirty six (36) hours later, the patient meets the criteria for PNEU. This is reported to NHSN as VAP for the SICU.
- Patient is transferred to the medical ward from the MSICU after having ventilator removed. Within 24 hours, the patient meets criteria for a PNEU. This is reported to NHSN as a VAP for the MSICU.
- Patient on a ventilator is transferred from the medical ward to the coronary care ICU (CCU). After 4 days in the CCU, the patient meets the criteria for a PNEU. This is reported to NHSN as a VAP for the CCU.
- Patient on the Respiratory ICU (RICU) of Hospital A had the endotracheal tube and ventilator removed and is discharged home a few hours later. The ICP 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 are reported.

Ventilator: A device to assist or control respiration continuously, including 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).

Algorithms for Pneumonia in Immunocompromised Patients

(Last updated June, 2008)

DEFINITION: Patient must meet the following Criterion:

☐ **Criterion**:

- ○ Patient has two or more serial chest radiographs with at least **ONE** Δ of the following:
  - Δ infiltrate is **ONE** ☐ of the following[1, 2]:
    - ☐ new
    - ☐ progressive and persistent
  - Δ consolidation
  - Δ cavitation
  - Δ 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 radiograph is acceptable[1].

AND

- ○ Patient who is immunocompromised[13] has at least **ONE** Δ of the following:
  - Δ fever (>38°C or >100.4°F) with no other recognized cause
  - Δ for adults ≥70 years old, altered mental status with no other recognized cause
  - Δ change in sputum production including **ONE** ☐ of the following:
    - ☐ new onset of purulent sputum[3]
    - ☐ change in character of sputum[4]
    - ☐ increased respiratory secretions
    - ☐ increased suctioning requirements
  - Δ symptoms of **ONE** of the following:
    - ☐ new onset cough
    - ☐ worsening cough
    - ☐ dyspnea
    - ☐ tachypnea[5]

- Δ exam findings of **ONE** of the following:
  - ☐ rales [6]
  - ☐ bronchial breath sounds
- Δ worsening gas exchange indicated by **ONE** ☐ of the following:
  - ☐ O_2 desaturations (e.g., $PaO_2/FiO_2 \leq 240$) [7]
  - ☐ increased oxygen requirements
  - ☐ increased ventilator demand
- Δ hemoptysis
- Δ pleuritic chest pain

AND

- ○ Patient has at least **ONE** Δ of the following:
  - Δ matching positive blood and sputum cultures with *Candida* spp. [14, 15]
  - Δ evidence of fungi or *Pneumocystis carinii* from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing) from **ONE** ☐ of the following:
    - ☐ direct microscopic exam
    - ☐ positive culture of fungi
  - Δ positive growth in blood culture [8] not related to another source of infection
  - Δ positive growth in culture of pleural fluid
  - Δ positive quantitative culture [9] from minimally contaminated LRT specimen (e.g., BAL or protected specimen brushing)
  - Δ ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (e.g., Gram stain)
  - Δ 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
    - ☐ positive quantitative culture [9] of lung parenchyma
    - ☐ evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae
  - Δ positive culture of virus or *Chlamydia* from respiratory secretions
  - Δ positive detection of **ONE** ☐ of the following:
    - ☐ viral antigen from respiratory secretions (e.g., EIA, FAMA, shell vial assay, PCR)
    - ☐ viral antibody from respiratory secretions (e.g., EIA, FAMA, shell vial assay, PCR)
  - Δ fourfold rise in paired sera (IgG) for pathogen (e.g., influenza viruses, *Chlamydia*)

Δ positive PCR for **ONE** ☐ of the following:
- ☐ *Chlamydia*
- ☐ *Mycoplasma*

Δ positive micro-IF test for *Chlamydia*

Δ patient has **ONE** ☐ of the following:
- ☐ positive *Legionella* culture
- ☐ positive visualization by micro-IF of *Legionella* spp, from **ONE** ○ of the following:
  - ○ respiratory secretions
  - ○ tissue

Δ detection of *Legionella pneumophila* serogroup 1 antigens in urine by **ONE** ☐ of the following:
- ☐ RIA
- ☐ EIA

Δ fourfold rise in *L. pneumo*phila serogroup 1 antibody titer to ≥1:128 in paired acute and convalescent sera by indirect IFA

Footnotes to Algorithms: ***(Last updated June, 2008)***

[1]Occasionally, in non-ventilated patients, the diagnosis of health care – associated pneumonia may be quite clear on the basis of symptoms, signs, and a single definitive chest radiograph. 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 presences of pneumonia. In these more difficult cases, serial chest radiographs must be examined to help separate infectious from noninfectious pulmonary processes. To help confirm difficult cases, it may be useful to review radiographs 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. Radiographic changes of pneumonia persist for several weeks. As a result, rapid radiographic resolution suggests that the patient does not have pneumonia but rather a noninfectious process such as atelectasis or congestive heart failure.

[2]Note that there are many ways of describing the radiographic 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 are alternative descriptive wording 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). If your laboratory reports these data qualitatively (e.g., “many WBCs” or “few squames”), be sure their descriptors match this definition of purulent sputum. This laboratory confirmation is required because written clinical descriptions of purulence are highly variable.

[4]A single notation of either purulent sputum or 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. A change in character of sputum refers to 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 infants <2 months old; >50 breaths per minute in infants 2 to 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]Care must be taken to determine the etiology of pneumonia in a patient with positive blood cultures and radiographic evidence of pneumonia, especially if the patient has invasive devices in place such as intravascular lines or an indwelling urinary catheter. In general, in an immunocompetent patient, blood cultures positive for coagulase-negative staphylococci, common skin contaminants, and yeasts will not be etiologic agent of the pneumonia.

[9]Refer to threshold values for cultured specimens (see table below). An endotrachial aspirate is not a minimally contaminated specimen. Therefore, an endotrachial aspirate does not meet the laboratory criteria.

[10]Once laboratory-confirmed due to pneumonia because of respiratory syncytial virus (RSV), adenovirus, or influenza virus have been identified in hospital, clinician’s presumptive diagnosis of these pathogens in subsequent cases with similar clinical signs and symptoms is an acceptable criterion for presence of health care-associated infection.

[11]Scant or watery sputum is commonly seen in adults with pneumonia due to viruses and Mycoplasma although sometimes the sputum may be mucopurulent. In infants, pneumonia due to RSV or influenza yields copious sputum. Patient, except premature infants, with viral or Mycoplasmal pneumonia may exhibit few signs or symptoms, even when significant infiltrates are present on radiographic exam.

[12]Few bacteria may be seen on stains of respiratory secretions for patients with pneumonia due to Legionella spp, mycoplasma, or viruses.

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

[14]Blood and sputum specimens must be collected within 48 hours of each other.

[15]Semiquantitative or non-quantitative cultures of sputum obtained by deep cough, induction, aspiration, or lavage are acceptable. If quantitative culture results are available, refer to algorithms that include such specific laboratory findings.

PNEUMONIA 3 (PNEU3)

Threshold Values: *(Last updated March, 2009)*

Specimen collection/technique;	**Values:**
Lung parenchyma*	≥10^4 cfu/g tissue
Bronchoscopically obtained specimens:	
Bronchoavleolar lavage	≥10^4 cfu/ml
Protected BAL	≥10^4 cfu/ml
Protected specimen brushing	≥10^4 cfu/ml
Nonbronchoscopically obtained (blind) specimens:	
Bronchoavleolar lavage	≥10^4 cfu/ml
Protected BAL	≥10^4 cfu/ml

cfu = culture-forming units

* Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or transbronchial biopsy

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GENERAL COMMENTS: *(Last updated June, 2008)*

1. Physician diagnosis of pneumonia alone is not an acceptable criterion for health care–associated pneumonia.

2. Although specific criteria are included for infants and children, pediatric patients may meet any of the other pneumonia specific site criteria.

3. Ventilator-associated pneumonia (i.e. pneumonia in persons who had a device to assist or control respiration continuously through a tracheostomy or by endotracheal intubation within the 48-hour period before the onset of infection, inclusive of the weaning period) should be so designated when reporting data.

4. 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 health care–associated pneumonia in the elderly, infants, and immunocompromised patients because such conditions may mask typical signs or symptoms associated with pneumonia. Alternate specific criteria for the elderly, infants and immunocompromised patients have been included in this definition of health care–associated pneumonia.

5. Health care–associated pneumonia can be characterized by its onset: early or late. Early onset pneumonia occurs during the first 4 days of hospitalization and is often caused by *Moraxella catarrhalis*, *H. influenzae*, and *S. pneumoniae*. Causative agents of late onset pneumonia are frequently gram negative bacilli or *S. aureus*, including methicillin-resistant *S. aureus*. Viruses (e.g. influenza A and B or respiratory syncytial virus) can cause early and late onset nosocomial pneumonia, whereas yeasts, fungi, legionellae, and *Pneumocystis carinii* are usually pathogens of late onset pneumonia.

6. Pneumonia due to gross aspiration (for example, in the setting of intubation in the emergency room or operating room) is considered health care associated if it meets any specific criteria and was not clearly present or incubating at the time of admission to the hospital.

7. Multiple episodes of health care–associated pneumonia may occur in critically ill patients with lengthy hospital stays. When determining whether to report multiple episodes of health care–associated pneumonia in a single patient, look for evidence of resolution of the initial infection. The addition of or change in pathogen alone is not indicative of a new episode of pneumonia. The combination of new signs and symptoms and radiographic evidence or other diagnostic testing is required.

8. Positive Gram stain for bacteria and positive KOH (potassium hydroxide) mount for elastin fibers and/or fungal hyphae from appropriately collected sputum specimens are important clues that point toward the etiology of the infection. However, sputum samples are frequently contaminated with airway colonizers and therefore must be interpreted cautiously. In particular, *Candida* is commonly seen on stain, but infrequently causes healthcare-associated pneumonia.

Abbreviations: ***(Last updated June, 2008)***

BAL – bronchioalveolar 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: ***(Last updated June, 2008)***

- There is a hierarchy of specific categories within the major type pneumonia (PNEU). 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 pneumonia.
- Lung abscess or empyema without pneumonia is classified as LUNG.
- Bronchitis, tracheitis, tracheobronchitis, or bronchiolitis without pneumonia are classified as BRON.