PNEUMONIA 3 (PNEU3)

(Revised January 1, 2017)

Healthcare-associated infections (HAI): All NHSN site specific infections must first meet the HAI definition as defined in the "Additional Information" checklist 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 7 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.

Present on Admission (POA): Infections that are POA, as defined in the "Additional Information" checklist, are not considered HAIs and therefore are never reported to NHSN.

NOTE: POA reporting exception for PNEU/VAP: One eligible chest imaging test is acceptable to satisfy the imaging parameter for PNEU/VAP-POA determinations, regardless of whether the patient has underlying pulmonary or cardiac disease.

Pneumonia (PNEU): is identified by using a combination of imaging, clinical and laboratory criteria. The following checklist details the various criteria that may be used for meeting the surveillance definition of healthcare-associated pneumonia, general comments applicable to all site-specific criteria, and reporting instructions 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 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 PNEU (VAP): A pneumonia where:

- The patient is on mechanical ventilation for >2 calendar days on the day 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 Day 1.

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: ***(Revised January 1, 2017)***

Transfer Rule: If the date of event for 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 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.

PNEUMONIA 3 (PNEU3)

Specific Site Algorithm for Pneumonia in Immunocompromised Patients

(Revised January 1, 2017)

DEFINITION: Patient must meet the following criterion:

☐ **Criterion**:

- Patient has two or more serial chest imaging test results with at least **ONE** Δ of the following[1,2]: New and persistent **OR** Progressive and persistent
  - Δ infiltrate
  - 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 imaging test result is acceptable[1].

AND

- Patient who is immunocompromised[10] has at least **ONE** Δ of the following:
  - Δ fever (>38.0°C or >100.4°F)
  - Δ for adults ≥70 years old, altered mental status with no other recognized cause
  - Δ **ONE** ☐ of the following:
    - ☐ new onset of purulent sputum[3]
    - ☐ change in character of sputum[4]
    - ☐ increased respiratory secretions
    - ☐ increased suctioning requirements
  - Δ **ONE** ☐ of the following:
    - ☐ new onset cough
    - ☐ worsening cough
    - ☐ dyspnea
    - ☐ tachypnea[5]
  - Δ **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 **ONE** ☐ of the following:
    - ☐ Identification of matching *Candida* spp from blood and sputum [11, 12,13]
    - ☐ Identification of matching *Candida* spp. from endotracial aspirate [11, 12,13]
    - ☐ Identification of matching *Candida* spp. from BAL or protected specimen brushing
  - Δ 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

OR ∗

- Patient has at least **ONE** Δ of the following:
  - Δ organism identified from blood culture[8, 13]
  - Δ organism identified from pleural fluid [9,13]
  - 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's stain)
  - Δ positive quantitative culture[9] of lung tissue
  - Δ histopathologic exam shows at least **ONE** ☐ of the following evidences of pneumonia:
    - ☐ choose **ONE** ○ of the following:
      - ○ abscess formation with intense PMN accumulation in bronchioles and alveoli
      - ○ foci of consolidation with intense PMN accumulation in bronchioles and alveoli

∗ **NOTE: Correction from "AND" to "OR" on August 11, 2017.**

☐ choose ONE ○ of the following:

- ○ evidence of lung parenchyma invasion by fungal hyphae evidence of
- ○ lung parenchyma invasion by fungal pseudo hyphae

Δ choose ONE ☐ of the following identified from respiratory secretions[#]:

- ☐ Virus
- ☐ *Bordetella*
- ☐ *Legionella*
- ☐ *Chlamydia*
- ☐ Mycoplasma

Δ choose ONE ☐ of the following identified from tissue[#]:

- ☐ Virus
- ☐ *Bordetella*
- ☐ *Legionella*
- ☐ *Chlamydia*
- ☐ *Mycoplasma*

Δ fourfold rise in paired sera (IgG) for pathogen (e.g., influenza viruses, *Chlamydia*)

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

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

- ☐ RIA
- ☐ EIA

[#] by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (e.g., not Active Surveillance Culture/Testing (ASC/AST).

Footnotes to Algorithms and Flow Diagram: *(Revised January 1, 2017)*

[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 “polymorph nuclear 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 broncho alveolar 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 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 identified from blood cannot be deemed secondary to a PNEU, unless the organism was also identified 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. Identification of matching *Candida* species from blood and sputum, endotracheal aspirate, BAL or protected specimen brushing can be used to satisfy the PNEU3 definition for immunocompromised patients.

[9]Refer to threshold values for cultured specimens with growth of eligible pathogens (see table titled "Threshold values for cultured specimens used in the diagnosis of pneumonia found on the next page).

Note:

- A sputum and endotracheal aspirate are not minimally-contaminated specimens and therefore, organisms identified from these specimens do not meet the laboratory criteria for PNEU2.
- 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 identified 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. Identification of matching *Candida* species from blood and sputum, endotracheal aspirate, BAL or protected specimen brushing can be used to satisfy the PNU3 definition for immunocompromised patients.

[10]Immunocompromised patients include

- those with neutropenia (absolute neutrophil count or total white blood cell count (WBC) <500/mm^3),
- those with leukemia, lymphoma, or who are HIV positive with CD4 count <200,
- those who have undergone a splenectomy;
- those who have a history of solid organ or hematopoietic stem cell transplant,
- those on cytotoxic chemotherapy
- those on steroids daily for >2 weeks).

[11]blood specimen and sputum, endotracheal aspirate, BAL or protected specimen brushing specimens 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.

[13]Identification of organism by a culture or non-culture based microbiological testing method which is performed for purposes of clinical diagnosis or treatment (e.g., not Active Surveillance Culture/Testing (ASC/AST)

PNEUMONIA 3 (PNEU3)

Threshold values for cultured specimens used in the diagnosis of pneumonia

(Revised January 1, 2017)

Specimen collection/technique	**Values**+
Lung tissue*	≥10^4 CFU/g tissue
Bronchoscopically (B) obtained specimens:	
Broncho alveolar 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 = culture-forming units ***g = gram*** ***ml = milliliter***

* Open-lung biopsy specimens and immediate post-mortem specimens obtained by transthoracic or trans bronchial 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.

Reporting instructions: ***(Revised January 1, 2017)***

- There is a hierarchy of specific categories within the major site pneumonia. If the patients 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.
- Pathogens and 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 organisms as PNEU.
- Lung abscess or empyema without pneumonia is classified as LUNG.

PNEUMONIA 3 (PNEU3)

General Comments Applicable to All Pneumonia Specific Site Criteria:

(Revised January 1, 2017)

- 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 site-specific 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 the Additional Information checklist.
- Excluded organisms 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 identified from lung tissue or pleural fluid specimens:
     i. *Candida* species* or yeast not otherwise specified
     ii. coagulase negative *Staphylococcus* species
     iii. *Enterococcus* species

Note: Candida species* or yeast not otherwise specified, coagulase-negative Staphylococcus species, and Enterococcus species identified from blood cannot be deemed secondary to a PNU2 or PNU3, unless the organism was also identified from a pleural fluid or lung tissue specimen.

> * *Candida* species isolated from sputum or endotracheal aspirate, bronchoalveolar lavage (BAL) specimens or protected specimen brushing combined with a matching organism isolated from a blood specimen can be used to satisfy the PNU3 definition.

3. Additionally, because organisms belonging to the following genera are typically causes of community-associated 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 any NHSN definition: *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus* and *Pneumocystis.*

- *Abbreviations used in the PNEU laboratory criteria:*

BAL	Bronchi alveolar lavage	LRT	Lower respiratory tract
EIA	Enzyme immunoassay	PMN	Polymorphonuclear leukocyte
IFA	Immunofluorescent antibody	RIA	Radioimmunoassay