Patient Safety Component
Pneumonia (PNEU) Event Surveillance

Jennifer Watkins, MPH, BSN, RN

National Healthcare Safety Network (NHSN)

Protocol and Training Team

2025 NHSN Annual Training

Objectives

At the conclusion of this presentation, participants will be able to

- Summarize the three Pneumonia (PNEU) algorithms and the requirements for each
- Describe eligible imaging test evidence, signs/symptoms, and laboratory evidence for PNEU
- Explain secondary bloodstream infection assignment to PNEU
- Apply the PNEU surveillance definitions to case studies

Abbreviations used in PNEU presentation

PNEU – NHSN pneumonia surveillance definition
PNU1, PNU2, PNU3 – NHSN PNEU algorithms
VAP – ventilator-associated pneumonia
HAI – healthcare-associated infection
POA – present on admission
DOE – date of event
IWP – infection window period
RIT – repeat infection timeframe
SBAP – secondary bloodstream infection attribution period
BSI – bloodstream infection

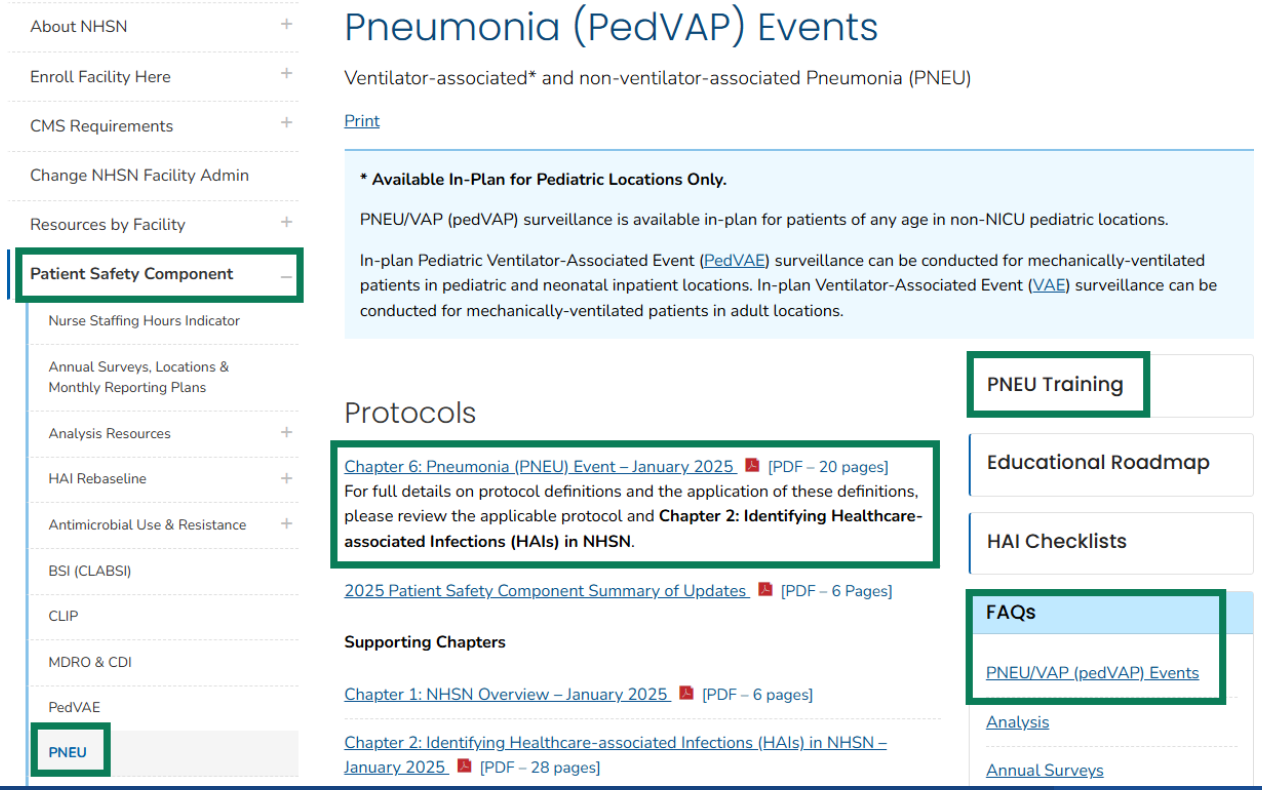
Abbreviations used in PNEU presentation, continued

HD – hospital day
S/S – signs/symptoms
BC – blood culture
LRT – lower respiratory tract
ETA – endotracheal aspirate
BAL – bronchoalveolar lavage
CFU/ml – colony forming units per milliliter
VRE – vancomycin resistant *Enterococcus*

PNEU Event Surveillance

NHSN Pneumonia (PNEU) webpage

- https://www.cdc.gov/nhsn/psc/pneu/index.html

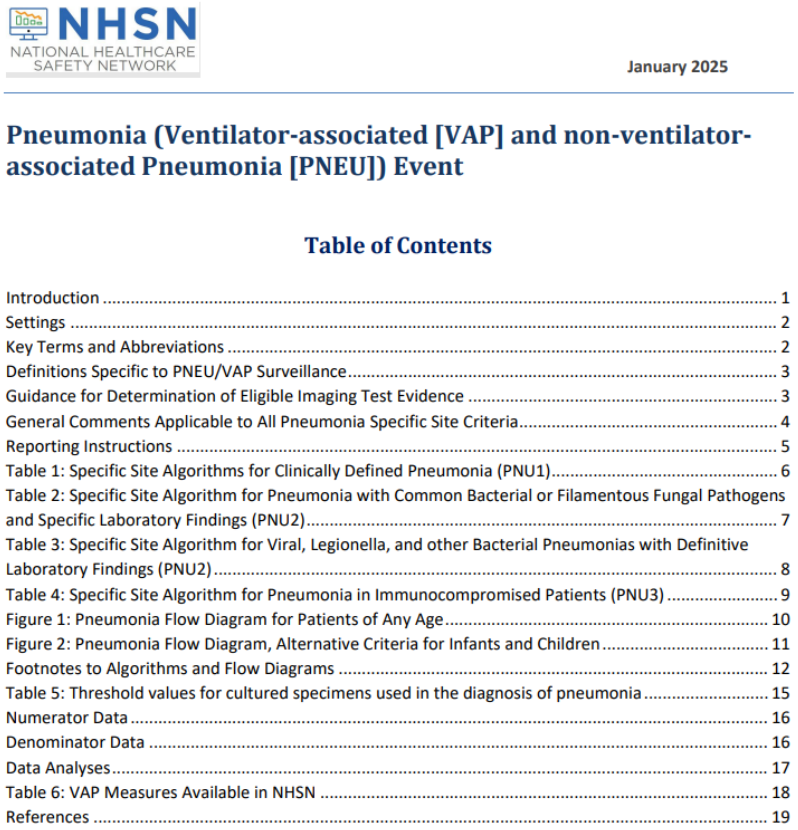


2025 NHSN Pneumonia (PNEU) surveillance protocol

2025 NHSN Patient Safety Component (PSC) Manual

Chapter 6: Pneumonia Event

https://www.cdc.gov/nhsn/pdfs/pscmanual/6pscvapcurrent.pdf



NHSN
NATIONAL HEALTHCARE SAFETY NETWORK

January 2025

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

Table of Contents

NHSN PNEU surveillance options

- **In-plan ventilator-associated pneumonia (VAP)** surveillance for patients in **pediatric locations** only (pedVAP)
- **Off-plan** non-ventilator pneumonia and ventilator-associated pneumonia surveillance for **any patient** regardless of age or location
- **Secondary bloodstream infection (BSI) assignment** for **all patients** regardless of age, location, or ventilation status

PNEU Definition Overview

PNEU criteria: PNU1, PNU2, PNU3

- PNEU is comprised of 3 criteria: PNU1, PNU2, and PNU3
- Must meet all elements of the criterion in the PNEU IWP
  - PNU1 – imaging, signs/symptoms
  - PNU2 – imaging, sign/symptoms, laboratory evidence
  - PNU3 – imaging, immunocompromised status, signs/symptoms, laboratory evidence
- Must meet the **footnote requirements**

PNEU: Footnotes

NOTE: The PNEU Algorithms (PNU1,2,3) and Flowcharts include **FOOTNOTE** references. The interpretation and guidance provided in the **FOOTNOTES** are an important part of the algorithms and must be incorporated into the decision-making process when determining if a PNEU definition is met.

- Several of the elements in the PNEU algorithms are footnoted
- Footnotes only apply to the element in which they are cited
- The **footnotes** provide additional guidance and instructions that **must be incorporated** into the decision-making process to determine if a PNEU definition can be met
- The footnotes are located on pages 6-12 through 6-15 in the 2025 PNEU chapter

PNU1 algorithm: Table 1

- PNU1 is ‘clinically defined’
  - No laboratory test evidence is required
- PNU1 required elements
  - Imaging Test Evidence
  - Signs/Symptoms

PNU1 algorithm: Table 1, continued

- 3 sets of criteria for Signs/Symptoms
  - Any Patient – patients of any age, including infants and children
  - Alternative Criteria – infants ≤ 1 year old
  - Alternative Criteria – child > 1 year old or ≤ 12 years old
- Age-specific alternative criteria apply to PNU1 only
  - Cannot be used for PNU2 or PNU3

PNU2 algorithm: Table 2 and Table 3

- PNU2 required elements
  - Imaging Test Evidence
  - Signs/Symptoms – no age-specific criteria
  - Laboratory evidence
- Algorithm split into 2 tables – Table 2 and Table 3
  - Imaging test evidence and signs/symptoms are the same in both tables
  - Laboratory evidence is different, but all meet PNU2

PNU3 algorithm: Table 4

- PNU3 is for immunocompromised patients
  - Immunocompromised definition in **footnote #10** must be met in order to apply PNU3
- PNU3 required elements
  - Imaging Test Evidence
  - Signs/Symptoms – no age-specific criteria
  - Laboratory evidence

PNEU criteria: General comments

- PNU1 includes age-specific sign/symptom criteria for infants and children
- PNU3 is specific to immunocompromised patients of any age
- These patients may also meet the other PNEU algorithms
  - Example: an infant can meet PNU1 Any Patient, PNU2, or PNU3
  - Example: an immunocompromised patient can meet PNU1 or PNU2

PNEU hierarchy

- There is a hierarchy for reporting if a patient meets more than one criterion during the infection window period (IWP) or the repeat infection timeframe (RIT):
  - 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

Knowledge Check #1

Which PNEU criterion doesn’t require laboratory evidence?

A. PNU1
B. PNU2
C. PNU3

Knowledge Check #1 - Rationale

Which PNEU criterion doesn’t require laboratory evidence?

Answer: PNU1

Rationale

PNU1 does not have a laboratory element and therefore does not have pathogens reported.

PNU2 and PNU3 require laboratory evidence from the Laboratory column in the algorithms.

Imaging Test Evidence

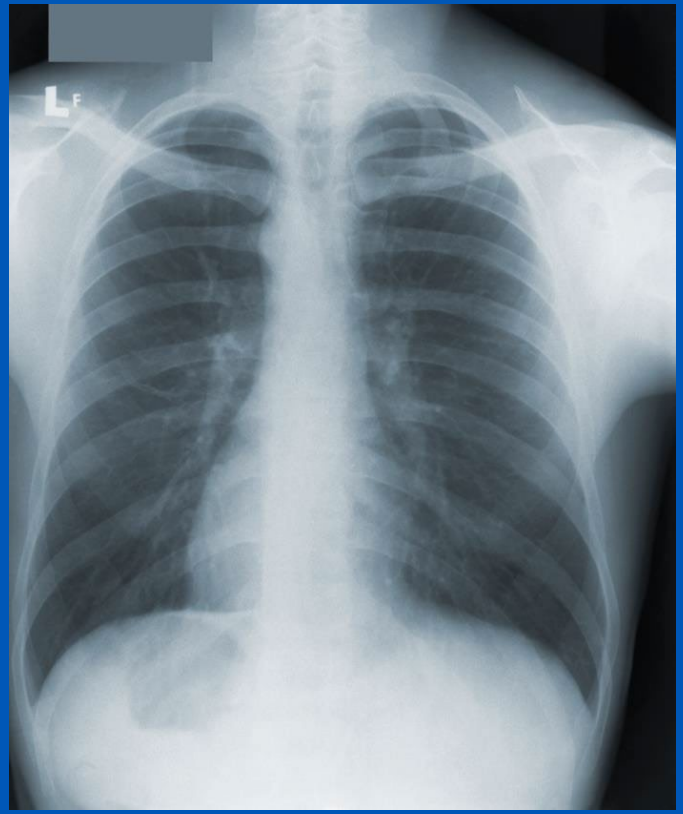


Image from phil.cdc.gov

Imaging Test Evidence - cont.

- Imaging requirement is the same for PNU1, PNU2, and PNU3
- Evidence of pneumonia that is
  - New and persistent
  - OR
  - Progressive and persistent
- **Footnotes #1, #2, #13**

Two or more serial chest imaging test results with at least ***one*** of the following (1,2,13):

New and persistent
or
Progressive and persistent

- Infiltrate
- Consolidation
- Cavitation
- Pneumatoceles, in infants ≤1 year old

Note: In patients ***without*** underlying pulmonary or cardiac disease (such as respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), at least one definitive chest imaging test result is acceptable. (1)

Imaging test evidence of pneumonia

- **Positive findings** listed in the PNEU criteria
  - Infiltrate
  - Consolidation
  - Cavitation
  - Pneumatoceles, in infants ≤ 1 year old

Imaging test evidence of pneumonia: Footnote #2

- **Alternative findings**
  - Opacities, densities, airspace disease
  - These are non-specific findings – may be representative of any number of disease processes
  - Considered to be potentially positive findings if not documented as something other than pneumonia
    - Eligible findings, example: bibasilar opacities, opacities compatible with pneumonia
    - Ineligible finding, example: opacities reflect atelectasis

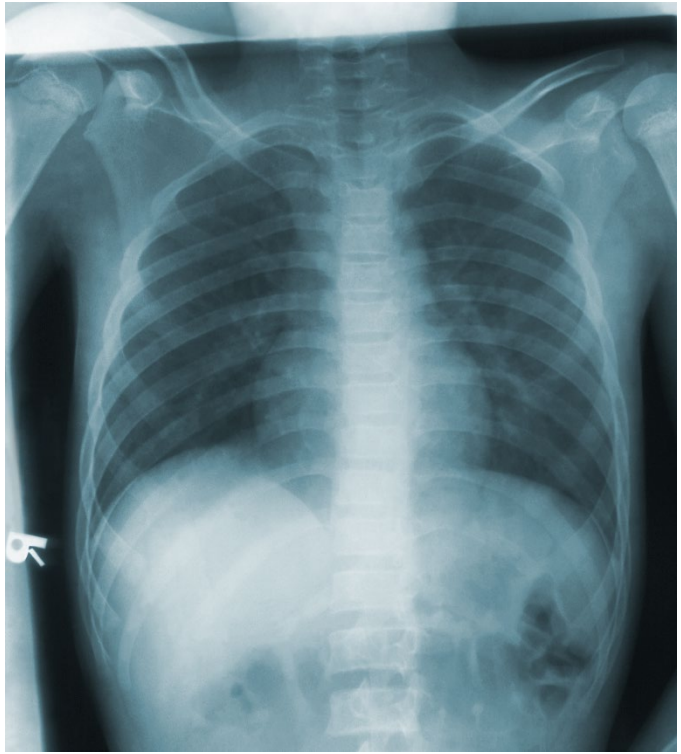
New and persistent or Progressive and persistent

Why is New and persistent or Progressive and persistent evidence of pneumonia required?

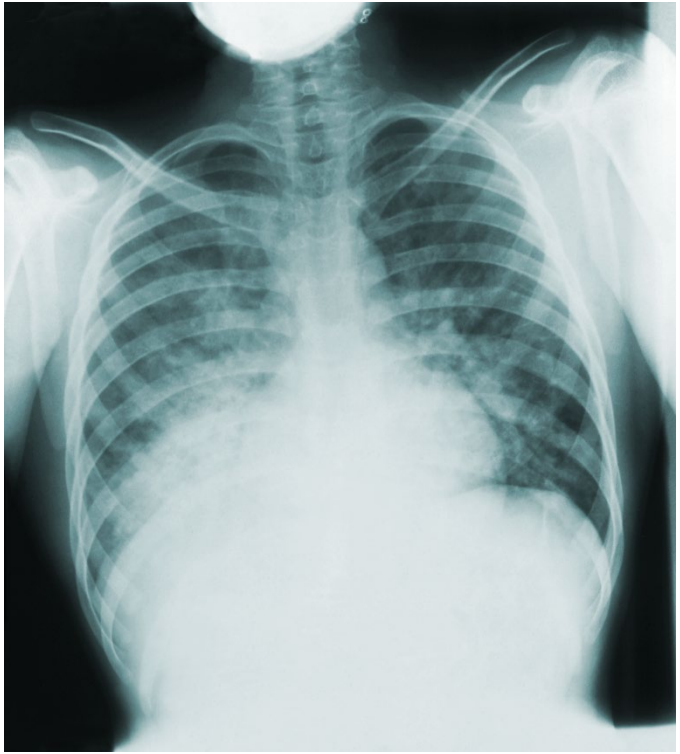
- Pneumonia may have rapid onset or progression
  - New or Progressive findings may indicate a new onset of pneumonia
- Pneumonia does not resolve quickly
  - Persistence of findings differentiates pneumonia from non-infectious processes, such as atelectasis or congestive heart failure

Pneumonia – rapid onset/progression

Day 1 – lungs clear



Day 2 – infiltrates



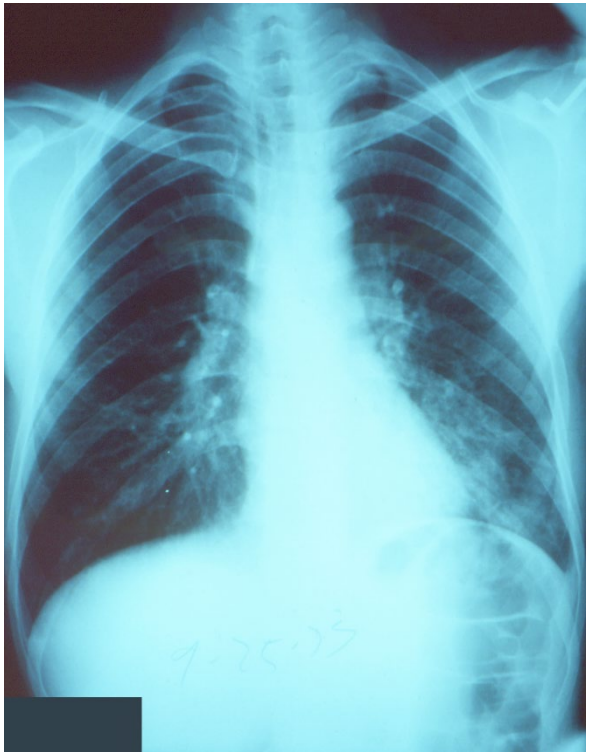
Images from phil.cdc.gov

New or Progressive

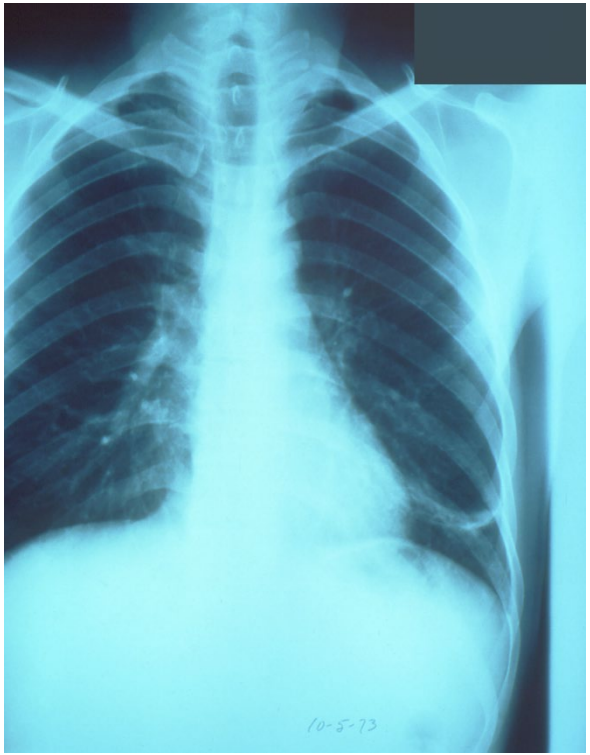
- **New or Progressive** is determined in comparison to prior imaging test findings
- **New** – findings were not present in prior imaging test
  - 3/10 imaging finding: lungs are clear
  - 3/12 imaging finding: infiltrates
- **Progressive** – findings are worse in comparison to prior imaging test
  - 3/10 imaging finding: infiltrates
  - 3/12 imaging finding: increased infiltrates compared to prior

Pneumonia - persistence

Consolidation



Consolidation persists 10 days later



Images from phil.cdc.gov

Persistence: Footnote #1

- **Persistence** is assessed by reviewing multiple imaging tests spanning over several calendar days
- Recommend following imaging tests for at least 7 days (if available) to determine persistence
  - Imaging tests used to determine persistence are not required to occur within the PNEU IWP
- Evidence of pneumonia will persist in subsequent imaging tests
  - If subsequent imaging indicates rapid resolution or attributes the finding to another condition, persistence is not met
- Persistence of findings of pneumonia is required for all patients

Persistence: Examples

HD	Imaging Results	Interpretation
1	Lungs clear	
2	Developing infiltrates	New finding
3	Worsening infiltrates	Worsening
4	Infiltrates	Persistence
5	Infiltrates similar to prior	Persistence
6	Some improvement of infiltrates	Persistence
7	Infiltrates	Persistence
8	No change in infiltrates	Persistence
9	Infiltrates improving	Persistence
10	Infiltrates slightly worse	Persistence, worsening
11	Infiltrates persist	Persistence
12	Infiltrates	Persistence

HD	Imaging Results	Interpretation
1	Worsening basilar opacities	Worsening finding
2	Basilar opacities	Persistence
3	Similar basilar infiltrates	Persistence
4	Basilar opacities	Persistence
5	Opacities persist	Persistence
6	Mild improvement basilar airspace disease	Persistence
7	Infiltrates persist	Persistence
8	Persistent basilar densities	Persistence
9	No change basilar opacities	Persistence
10	Improving basilar opacities	Persistence

No persistence: Examples

Rapid Resolution

HD	Imaging Results	Interpretation
1	Lungs clear	
2	Developing opacities	New finding
3	Worsening opacities	Worsening
4	Opacities, significantly improved	
5	Trace opacities	
6	Lungs clear	Resolution
7		

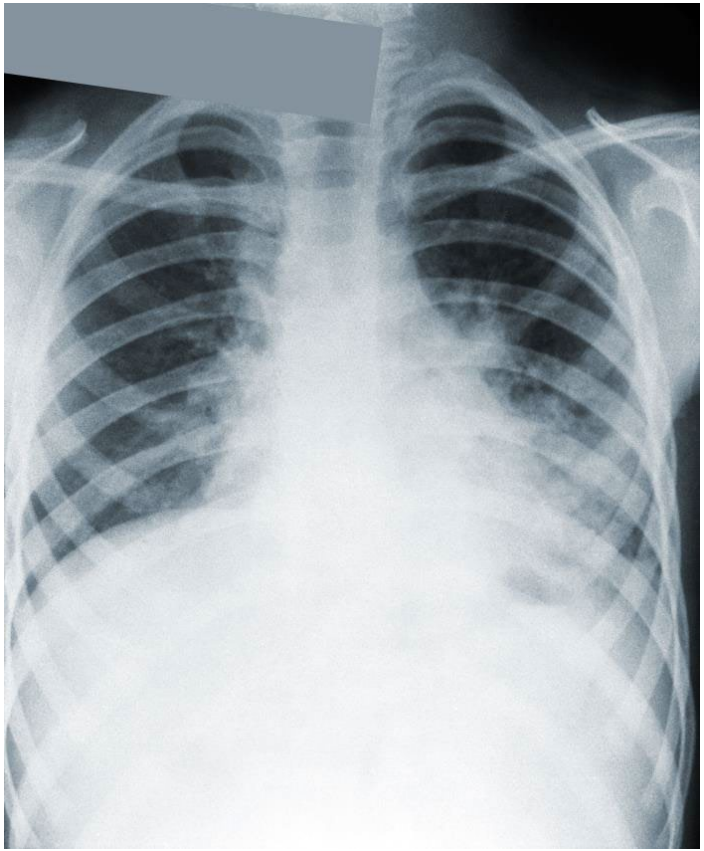
Rapid resolution

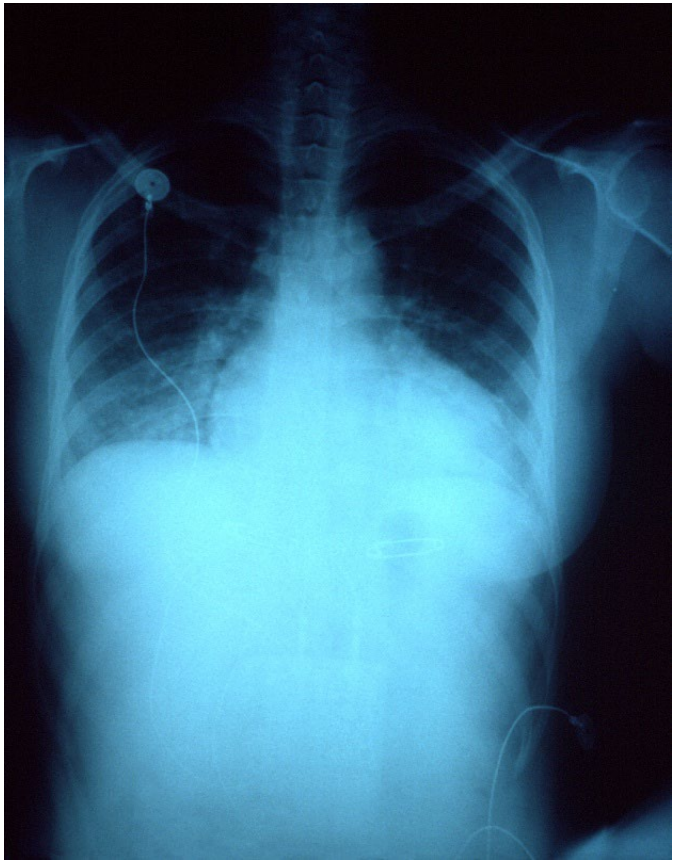
HD	Imaging Results	Interpretation
1	Diffuse opacities	New finding
2	Diffuse opacites	
3	Opacities improved	
4	Mild opacities	
5	No acute cardiopulmonary process noted	Resolution
6		
7		

Attribution to another issue

HD	Imaging Results	Interpretation
1	Opacites	New
2	Respiratory distress syndrome (RDS)	Not pneumonia
3	Opacities	
4	Continued opacities	
5	Lung disease of prematurity	Not pneumonia
6	Opacities reflective of RDS	Attribution to other than pneumonia
7	Worsening opacities	Worsening
8	Opacities, likely RDS	Attribution to other than pneumonia

Pneumonia vs. Congestive heart failure





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Patients without underlying pulmonary or cardiac disease

For patients without underlying cardiac or pulmonary disease, "*at least one definitive chest imaging test result*…"

- If only one imaging test is available and the findings are definitive for pneumonia, the single imaging test will meet the imaging requirement
- When multiple imaging tests are available, the subsequent imaging tests must be reviewed for persistence

Patients with underlying pulmonary or cardiac disease

For patients with underlying cardiac or pulmonary disease, "*two or more serial chest imaging test results…*"

- Two or more serial imaging test results demonstrating persistent evidence of pneumonia are required
- Imaging findings of some cardiac and pulmonary diseases may look like pneumonia
  - Subsequent imaging tests must be reviewed to ensure the findings reflect pneumonia and not the underlying disease process
- Exception: if only one definitive imaging test is available, it can be used to meet the imaging requirement for present on admission (POA) determinations only

Definitive vs. Equivocal imaging findings

- **Definitive imaging** – findings identify pneumonia
- **Equivocal imaging** – findings do not conclusively identify an infection or an infectious process
  - Infiltrate vs. atelectasis
  - Opacity may represent pneumonia or pulmonary edema
  - Consolidation consistent with pulmonary hemorrhage
- Equivocal imaging findings can be considered for use in meeting the PNEU imaging requirement, if the requirements in footnote #13 are met

Clarifying equivocal imaging findings: Footnote #13

- First, look for further imaging test evidence that clarifies the equivocal imaging finding:
  - Subsequent imaging findings are definitive for pneumonia – verifies the equivocal finding is representative of pneumonia, and therefore the equivocal finding is eligible for use

OR

  - Subsequent imaging findings no longer show evidence of pneumonia – verifies the finding is **not** representative of pneumonia, and therefore the equivocal finding **not** eligible for use

Equivocal imaging: Clinical correlation

- What if the imaging findings continue to be equivocal?
- In the absence of clarification of equivocal findings by subsequent imaging, **then and only then** can clinical correlation be used
  - Clinical correlation for PNEU is specifically physician documentation of antimicrobial treatment for pneumonia
- If the imaging does not demonstrate eligible findings of pneumonia, clinical correlation cannot be used

Equivocal imaging: Examples

Eligible

HD	Imaging Results	Interpretation
1	New infiltrate or atelectasis	Equivocal
2		
3	Infiltrate or atelectasis	Equivocal
4		
5		
6	Infiltrate	Definitive for pneumonia
7	Infiltrate	Definitive for pneumonia

Not eligible

HD	Imaging Results	Interpretation
1	New infiltrate	Definitive for pneumonia
2		
3	Infiltrate or pulmonary edema	Equivocal
4		
5		
6	Pulmonary edema	No evidence of pneumonia
7	Pulmonary edema	No evidence of pneumonia

Eligible with clinical correlation

HD	Imaging Results	Interpretation
1	New consolidation vs. atelectasis	Equivocal
2		
3	Consolidation vs. atelectasis	Equivocal
4		
5		
6	Consolidation vs. atelectasis	Equivocal
7	Consolidation vs. atelectasis	Equivocal

Imaging (radiology) reports

- Documentation of the radiologist's review of the imaging test
- Imaging reports typically contain "findings" and "impressions"
  - Findings - what the radiologist sees
  - Impressions - the radiologist's assessment of what the findings represent
- Both the findings and impressions - the "whole imaging picture" - must be considered when determining if the imaging test results are eligible for use in meeting PNEU

Summary: Imaging test evidence of pneumonia

- Findings must be new **and** persistent OR progressive **and** persistent
- Simply finding key words such as infiltrate, consolidation, or opacity in an imaging report is not sufficient - the findings must be considered in the context of the complete imaging report
- Unlike imaging for other NHSN events, due to the persistence requirement, all available imaging tests that are temporally related must be considered
- Footnotes #1, #2, and #13 must be followed when determining if the imaging requirement is met

Knowledge Check #2

True or False: The PNEU imaging requirement is met with the following imaging test findings.

3/14 – Lungs are clear bilaterally

3/15 – Interval development of bibasilar infiltrates

3/18 – Infiltrates persist

3/20 – Bilateral infiltrates

3/21 – Some improvement in bilateral infiltrates

Knowledge Check #2 - Rationale

Answer: True.

Rationale

The PNEU imaging requirement is met with imaging tests demonstrating new definitive findings that are persistent.

3/14 – Lungs are clear bilaterally

3/15 – Interval development of bibasilar infiltrates **New definitive finding**

3/18 – Infiltrates persist **Persistent definitive finding**

3/20 – Bilateral infiltrates **Persistent definitive finding**

3/21 – Some improvement in bilateral infiltrates **Persistent definitive finding**

Knowledge Check #3

True or False: The PNEU imaging requirement is met with the following imaging test findings.

5/2 – Increasing opacities

5/3 – Opacities, may represent infiltrates vs. pulmonary edema

5/5 – Worsening bibasilar opacities likely worsening pulmonary edema

5/6 – Bibasilar pulmonary edema

No additional imaging tests performed

Knowledge Check #3 - Rationale

Answer: False.

Rationale

The PNEU imaging requirement is NOT met with the following imaging test findings. Evidence of pneumonia is not persistent.

5/2 – Increasing opacities **Progressive non-specific finding**

5/3 – Opacities, may represent infiltrates vs. pulmonary edema **Equivocal finding**

5/5 – Worsening bibasilar opacities likely worsening pulmonary edema **Finding attributed to something other than pneumonia**

5/6 – Bibasilar pulmonary edema **No evidence of pneumonia**

No additional imaging tests performed

Signs/Symptoms

Image from phil.cdc.gov

PNU1: Any patient

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

One (1) of these

And at least ***two*** of the following (from separate bullets):

- New onset of purulent sputum (3) or change in character of sputum (4), or increased respiratory secretions, or increased suctioning requirements
- Dyspnea, or tachypnea (5), or new onset or worsening cough
- Rales (6) or bronchial breath sounds
- Worsening gas exchange (for example, O_2 desaturations [for example, PaO_2/FiO_2 ≤ 240] (7), increased oxygen requirements, or increased ventilator demand)

PLUS

At least two (2) of these

- the 2 qualifying signs/symptoms must be from different bullets

PNU1: Infants ≤ 1 year old

ALTERNATE CRITERIA, for infants ≤ 1 year old:

Worsening gas exchange (for example, O_2 desaturations [for example, pulse oximetry < 94%], increased oxygen requirements, or increased ventilator demand)

This

And at least ***three*** of the following (from separate bullets):

- 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)

PLUS

At least three (3) of these

- the 3 qualifying signs/symptoms must be from different bullets

PNU1: Child > 1 year old or ≤ 12 years old

ALTERNATE CRITERIA, for child > 1 year old or ≤ 12 years old, at least ***three*** of the following (from separate bullets):

- 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
- Dyspnea, or apnea, or tachypnea (5), or new onset or worsening cough
- Rales (6) or bronchial breath sounds
- Worsening gas exchange (for example, O_2 desaturations [for example, pulse oximetry < 94%], increased oxygen requirements, or increased ventilator demand)

At least three (3) of these

- the 3 qualifying signs/symptoms must be from different bullets

PNU2 (Table 2 and Table 3)

One (1) of these **PLUS** At least one (1) of these

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
- Dyspnea, or tachypnea (5), or new onset or worsening cough
- Rales (6) or bronchial breath sounds
- Worsening gas exchange (for example, O_2 desaturations [for example, $PaO_2/FiO_2 \leq 240$] (7), increased oxygen requirements, or increased ventilator demand)

- Same criteria applies to all patients of all ages
- No age-specific criteria (cannot apply age-specific criteria from PNU1 to meet PNU2)

PNU3: Immunocompromised Patients

Must meet the PNEU immunocompromised definition

Patient who is immunocompromised (see definition in footnote 10) has at least ***one*** of the following:

PLUS

At least one (1) of these

- 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
- Dyspnea, or tachypnea (5), or new onset or worsening cough
- Rales (6) or bronchial breath sounds
- Worsening gas exchange (for example, O_2 desaturations [for example, $PaO_2/FiO_2 \leq 240$] (7), increased oxygen requirements, or increased ventilator demand)
- Hemoptysis
- Pleuritic chest pain

Footnote #10: Immunocompromised patients

10. Immunocompromised patients include only

- those with neutropenia defined as 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 splenectomy
- those who have a history of solid organ or hematopoietic stem cell transplant
- those on cytotoxic chemotherapy
- those on enteral or parenteral administered steroids (excludes inhaled and topical steroids) daily for > 14 consecutive days on the date of event

Signs/Symptoms: A few key points

- Fever, leukopenia, and leukocytosis must meet the defined parameters
  - Leukocytosis parameters are different for PNU1 Alternative criteria for infants and child
- Breath sounds
  - Wheezing and rhonchi are only eligible to meet PNU1, Alternative criteria for infants ≤ 1 year old (not eligible for PNU1 any patient, PNU1 child, PNU2, or PNU3)
- Don't forget about the **FOOTNOTES**!!!

Footnote #3

- New onset of purulent sputum (3): **footnote #3** – purulent secretions must meet the quantitative laboratory definition
  - clinical documentation of “purulent” does not meet the criterion

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 (for example, “many WBCs” or “few squamous epithelial cells”). This laboratory confirmation is required since written clinical descriptions of purulence are highly variable.

Footnote #5

- Tachypnea (5): **footnote #5** – documented respiratory rate (breaths per minute) must meet the age-based parameters
  - Clinical documentation of "tachypnea" does not meet the criterion

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.

Knowledge Check #4

The PNU1 Alternative Criteria for infants ≤ 1 year old can be used with the PNU2 and PNU3 algorithms.

A. True
B. False

Knowledge Check #4 - Rationale

Answer: False

The PNU1 Alternative Criteria for infants ≤ 1 year old CANNOT be used with the PNU2 and PNU3 algorithms.

Rationale

The PNU1 Alternative Criteria for infants and for children can only be used with the PNU1 criterion.

PNU2 and PNU3 do not have age-specific sign/symptom criteria.

Image from phil.cdc.gov

Laboratory Test Evidence

PNEU pathogen exclusions

All *Candida* species or yeast not otherwise specified
All coagulase-negative *Staphylococcus* species
All *Enterococcus* species

- Excluded as a *site-specific pathogen* **unless** isolated from *lung tissue or pleural fluid*
- If identified from *blood*, the excluded pathogens can **only** be attributed as secondary to PNEU if PNU2 or PNU3 is met with a *matching organism* isolated from *lung tissue or pleural fluid* and the blood specimen is collected in the secondary BSI attribution period

PNEU pathogen exclusions, continued

All *Candida* species or yeast not otherwise specified

Exception: *Candida* species are eligible for use in meeting PNU3

IF

- Patient meets the immunocompromised definition (footnote #10)
- Matching *Candida* species are identified from a respiratory specimen and blood specimen, and both specimens have a collection date in the same infection window period (IWP)

PNU2 laboratory evidence: Blood specimen

- **PNU2, Table 2, p. 6-7:**
  - Organism identified from blood (8,12)

Corresponding footnotes:

8. Any coagulase-negative *Staphylococcus* species, any *Enterococcus* species, and any *Candida* species or yeast not otherwise specified that are identified from blood cannot be deemed secondary to a PNEU event unless the organism was also identified from lung tissue or pleural fluid (where specimen was obtained during thoracentesis or within 24 hours of chest tube placement; a pleural fluid specimen collected after a chest tube is repositioned or from a chest tube in place > 24 hours is not eligible). This applies when meeting PNU2 or when meeting PNU3 (for patients meeting the immunocompromised definition) with the laboratory findings found in PNU2. Identification of matching *Candida* spp. from blood and sputum, endotracheal aspirate, BAL, or protected specimen brushing with specimen collection dates in the same IWP can be used to satisfy PNU3 definition for patients meeting the immunocompromised definition (see footnote 10).

12. Identification of organism by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST)).

PNU2 laboratory evidence: Lower respiratory tract (LRT) specimen

- **PNU2, Table 2, p. 6-7**

- Positive quantitative culture or corresponding semi-quantitative culture result (9) from minimally contaminated LRT specimen (***specifically, BAL, protected specimen brushing, or endotracheal aspirate***)

Corresponding footnote:

9. Refer to threshold values in Table 5 for cultured specimens (lung tissue, BAL, protected specimen brushing, or endotracheal aspirate) with growth of eligible pathogens.

Notes:

- A specimen that is not obtained through an artificial airway (specifically an endotracheal tube or a tracheostomy) from a ventilated patient is not considered minimally contaminated and is not eligible for use in meeting the laboratory criteria for PNEU (PNU2 or PNU3 when using the laboratory findings found in PNU2). Sputum or tracheal secretions collected from a non-ventilated patient are not minimally contaminated specimens.
- The following organisms can only be used to meet PNEU definitions when identified from lung tissue or pleural fluid obtained during thoracentesis or within 24 hours of chest tube placement (not from a chest tube that has been repositioned or from a chest tube that has been in place > 24 hours):
  - Any coagulase-negative *Staphylococcus* species
  - Any *Enterococcus* species
  - Any *Candida* species or yeast not otherwise specified.
    - Exception: identification of matching *Candida* spp. from blood and sputum, endotracheal aspirate, BAL, or protected specimen brushing with specimen collection dates in the same IWP can be used to satisfy PNU3 definition for immunocompromised patients (see footnote 10).

PNU2 laboratory evidence: Table 5

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
Endotracheal aspirate (ETA)	≥ 10^5 CFU/ml

CFU = colony forming units, g = gram, ml = milliliter

*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" or "many" or "numerous" growth, or 2+, 3+, or 4+ growth is considered to correspond.

†Lung tissue specimens obtained by either open or closed lung biopsy methods. For post-mortem specimens, only lung tissue specimens obtained by transthoracic or transbronchial biopsy that are collected immediately post-mortem are eligible for use.

PNU2 laboratory evidence: Lung tissue & pleural fluid

- **PNU2, Table 2, p. 6-7**
  - Organism identified from pleural fluid (9,12)
  - Positive quantitative culture or corresponding semi-quantitative culture result (9) of lung tissue

- Eligible specimens for *Candida, Enterococcus*, and coagulase-negative *Staphylococcus* species
- Pleural fluid – organisms can be identified with any amount of growth
- Lung tissue – organisms must be identified on culture with growth that meets the threshold values in Table 5
- Review footnotes for additional requirements for pleural fluid and lung tissue

PNU2 laboratory evidence: Viruses

- **PNU2, Table 3, p. 6-8**

- Virus, *Bordetella, Legionella, Chlamydia, or Mycoplasma* identified from respiratory secretions or tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST)

- Posterior nasal and nasopharyngeal (NP) swab specimens are eligible specimens
- Both culture and non-culture-based test results are eligible

PNU3 laboratory evidence: Matching *Candida* species

- **PNU3, Table 4, p. 6-9:**

- Identification of matching *Candida* spp. from blood and one of the following respiratory specimens: sputum, endotracheal aspirate, BAL, or protected specimen brushing (11,12); blood specimen and respiratory specimen must have collection dates that occur within the same IWP

Corresponding footnotes:

11. Sputum obtained by any method (such as deep cough, induction, aspiration, or lavage) are acceptable specimens. Any quantity of organism identified is acceptable, to include all non-quantitative, semi-quantitative, and quantitative results.

12. Identification of organism by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST)).

PNU3 laboratory evidence: PNU2 criteria

- **PNU3, Table 4, p. 6-9**

OR

Any of the following from:

LABORATORY CRITERIA DEFINED UNDER PNU2

- Any of the laboratory criteria listed in PNU2 (Tables 2 and 3) can be used to meet PNU3 for immunocompromised patients
- Footnotes associated with the PNU2 laboratory criteria still apply when using them to meet PNU3

Knowledge Check #5

An endotracheal aspirate specimen with a final culture result of ≥ 10^5 CFU/ml *Enterococcus faecium* can be used to meet PNEU criteria.

A. True
B. False

Knowledge Check #5 - Rationale

Answer: False. An endotracheal aspirate culture result of ≥ 10^5 CFU/ml *Enterococcus faecium* does not meet PNEU criteria because *Enterococcus faecium* is an excluded organism.

Rationale

There are 3 parts for meeting this laboratory element:

1. Specimen – endotracheal aspirate is an eligible specimen
2. Amount of growth on culture – for ETA specimen, ≥ 10^5 CFU/ml meets the Table 5 quantitative values
3. Organism - *Enterococcus faecium* can only be used to meet PNU2 or PNU3 criteria when identified from lung tissue or pleural fluid

PNEU – Secondary BSI Assignment

PNEU and Secondary BSI assignment*

A PNEU site-specific definition must be met

AND

One of the following scenarios must be met

Scenario 1:

At least one organism from the blood specimen matches an organism identified from the site-specific specimen that is used as an element to meet the **PNEU** criterion AND the blood specimen is collected during the secondary BSI attribution period (SBAP) [infection window period + repeat infection timeframe]

OR

Scenario 2:

An organism identified in the blood specimen is an element that is used to meet **PNEU** criterion, and therefore is collected during the site-specific infection window period (IWP)

*BSI Protocol https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf Appendix: Secondary BSI Guide

Key concepts for Secondary BSI assignment to PNEU

- Pathogens cannot be reported for PNU1 events
  - PNU1 criterion does not include a site-specific specimen or a blood specimen
  - Therefore, a secondary BSI cannot be assigned to PNU1

- Pathogens can be reported for PNU2 and PNU3 events
  - Therefore, a secondary BSI can be assigned to PNU2 and PNU3, if one of the secondary BSI scenarios is met

BSI secondary to PNEU: Scenario 1, Example 1

HD	SBAP	RIT	IWP
1			
2			
3			
4	DOE	1	New onset cough
5		2	Imaging: New infiltrate
6		3	Fever >38.0°C
7		4	Imaging: Infiltrate
8		5	BAL: many *E. coli*
9		6	Imaging: Infiltrate
10		7	
11	BC+	8	Blood Culture: *E. coli*
12		9	Imaging: Infiltrate

- **PNU2 is met with an eligible site-specific specimen and culture result**
- **Blood specimen collection date is within the PNEU SBAP**
- **Cultures have matching organisms**

PNU2 with a Secondary BSI

Date of Event = Hospital Day 4

Pathogen: *E. coli*

Secondary BSI to PNEU – Excluded pathogens

Candida species or yeast not otherwise specified
Coagulase-negative _Staphylococcus_ species
Enterococcus species

- When applying Scenario 1, excluded pathogens identified from blood can only be attributed as a secondary BSI to PNEU
  - If PNU2 or PNU3 is met with a matching organism identified from lung tissue or pleural fluid
  - And the blood specimen with a matching organism has a collection date in the PNEU SBAP

BSI secondary to PNEU: Scenario 1, Example 2

HD	SBAP	RIT	IWP
1			
2			
3			
4	DOE	1	New onset cough
5		2	Imaging: New infiltrate
6		3	Fever >38.0°C
7		4	Imaging: Infiltrate
8		5	Pleural fluid: *Enterococcus spp.*
9		6	Imaging: Infiltrate
10		7	
11	BC+	8	BC: *Enterococcus spp.*
12		9	Imaging: Infiltrate

- **PNU2 is met with an eligible site-specific specimen and culture result**
- ***Enterococcus* species are not excluded when identified in lung tissue or pleural fluid**
- **Blood specimen collection date is within the PNEU SBAP**
- ***Enterococcus* BSI can be assigned as secondary to PNU2 in this case**

PNU2 with a Secondary BSI

Date of Event = Hospital Day 4

Pathogen: *Enterococcus spp.*

Secondary BSI to PNEU – Excluded pathogens, continued

- Pathogens excluded from site-specific infection definitions are also excluded as pathogens for BSIs secondary to that type of infection
- The excluded pathogens cannot be assigned to one of these infections as a pathogen, even if identified in the same blood specimen as an eligible pathogen
- Pathogen Assignment Guidance, Chapter 2, p. 2-22

BSI secondary to PNEU: Scenario 1, Example 3

HD	SBAP	RIT	IWP
1			
2			
3			
4	DOE	1	New onset cough
5		2	Imaging: New infiltrate
6		3	Fever >38.0°C
7		4	Imaging: Infiltrate
8		5	ETA: 4+ *K. pneumoniae*
9		6	Imaging: Infiltrate
10		7	
11	BC+	8	Blood Culture: VRE and *K. pneumoniae*
12		9	Imaging: Infiltrate

- **PNU2 is met with an eligible site-specific specimen and culture result**
- **Blood specimen collection date is within the PNEU SBAP**
- **Cultures have at least one matching organism**
- **BUT – VRE is an excluded pathogen and cannot be assigned as a secondary BSI pathogen to PNEU**

PNU2 with a Secondary BSI

Date of Event = Hospital Day 4

Pathogen: *K. pneumoniae*

BSI Secondary to PNEU: Scenario 2

Blood specimen as an element of the PNEU criteria

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

NOTE: The PNEU Algorithms (PNU1,2,3) and Flowcharts include **FOOTNOTE** references. The interpretation and guidance provided in the **FOOTNOTES** are an important part of the algorithms and must be incorporated into the decision-making process when determining if a PNEU definition is met.

Imaging Test Evidence	Signs/Symptoms	Laboratory
Two or more serial chest imaging test results with at least ***one*** of the following (1,2,13): New and persistent **or** Progressive and persistent • Infiltrate • Consolidation	At least ***one*** of the following: • Fever (> 38.0°C or > 100.4°F) • Leukopenia (≤ 4000 WBC/mm³) or leukocytosis (≥ 12,000 WBC/mm³) • For adults ≥ 70 years old, altered mental status with no other recognized cause And at least ***one*** of the following:	At least ***one*** of the following: • Organism identified from blood (8,12) • Organism identified from pleural fluid (9,12) • Positive quantitative culture or corresponding semi-quantitative culture result (9) from minimally contaminated LRT specimen

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

NOTE: The PNEU Algorithms (PNU1,2,3) and Flowcharts include **FOOTNOTE** references. The interpretation and guidance provided in the **FOOTNOTES** are an important part of the algorithms and must be incorporated into the decision-making process when determining if a PNEU definition is met.

Imaging Test Evidence	Signs/Symptoms	Laboratory
Two or more serial chest imaging test results with at least ***one*** of the following (1,2,13): New and persistent **or** Progressive and persistent • Infiltrate	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 of sputum (4), or	At least ***one*** of the following: • Identification of matching *Candida* spp. from blood and one of the following respiratory specimens: sputum, endotracheal aspirate, BAL, or protected specimen brushing (11,12); blood specimen and respiratory specimen must have collection dates that occur within the same IWP

BSI secondary to PNEU: Scenario 2, Example 1

HD	SBAP	RIT	IWP
1			
2			
3			
4	DOE	1	Dyspnea
5		2	Imaging: New infiltrate
6		3	Leukocytosis
7	BC+	4	BC: *S. aureus*
8		5	Imaging: Infiltrate
9		6	Imaging: Infiltrate
10		7	
11		8	
12		9	Imaging: Infiltrate

- **Eligible organism is identified from a blood specimen with a collection date within the IWP**
- **Organism identified from blood is used to meet the PNU2 criterion**

PNU2 with a Secondary BSI

Date of Event = Hospital Day 4

Pathogen: *S. aureus*

BSI secondary to PNEU: Scenario 2, Example 2

HD	SBAP	RIT	IWP
1			HIV+ with CD4 count < 200
2			
3			
4	DOE	1	Fever >38.0°C
5		2	Imaging: New infiltrate Sputum culture: *Candida spp.*
6		3	
7		4	Imaging: Infiltrate
8	BC +	5	*BC: Candida albicans*
9		6	Imaging: Infiltrate
10		7	
11		8	
12		9	Imaging: Infiltrate

- **Patient meets the PNEU immunocompromised definition**
- **Matching *Candida* spp. in blood and respiratory specimens**
- **Both specimens with collection dates in the PNU3 IWP**
- **Organism identified from blood is used to meet the PNU3 criterion**
- **Reminder: this is specific to *Candia* spp. only**

PNU3 with a Secondary BSI

Date of Event = Hospital Day 4

Pathogen: *Candida albicans*

PNEU Case Studies

Case Study #1

Which PNEU criterion is met in this scenario?

HD	PNEU Elements
1	Imaging: lungs clear
2	
3	Leukocytosis
4	Imaging: bilateral infiltrates
5	Endotracheal aspirate culture: +1 growth *S. aureus*
6	Imaging: bilateral infiltrates Rales, fever > 38.0°C
7	Imaging: bilateral opacities
8	
9	Imaging: unchanged opacities
10	
11	Imaging: slight improvement in bilateral infiltrates

A. PNU1
B. PNU2
C. PNU3
D. No PNEU criteria are met

Case Study #1 – Answer, part 1

Which PNEU criterion is met in this scenario?

HD	PNEU Elements
1	Imaging: lungs clear
2	
3	Leukocytosis
4	Imaging: bilateral infiltrates
5	Endotracheal aspirate culture: +1 growth *S. aureus*
6	Imaging: bilateral infiltrates Rales, fever > 38.0℃
7	Imaging: bilateral opacities
8	
9	Imaging: unchanged opacities
10	
11	Imaging: slight improvement in bilateral infiltrates

- **Imaging requirement is met**
- Day 4 imaging test – new evidence of pneumonia
- Day 6 – 11 imaging tests – persistent evidence of pneumonia
- Day 4 imaging test is first positive diagnostic test for meeting PNEU and sets a PNEU IWP from Day 1 – Day 7

Case Study #1 – Answer, part 2

Which PNEU criterion is met in this scenario?

HD	PNEU Elements
1	Imaging: lungs clear
2	
3	Leukocytosis
4	Imaging: bilateral infiltrates
5	Endotracheal aspirate culture: +1 growth *S. aureus*
6	Imaging: bilateral infiltrates Rales, fever > 38.0°C
7	Imaging: bilateral opacities
8	
9	Imaging: unchanged opacities
10	
11	Imaging: slight improvement in bilateral infiltrates

No PNEU criteria are met

- PNU2/3 not met - endotracheal aspirate culture results do not meet quantitative/semi-quantitative requirements (Table 5, PNEU chapter)
- PNU1 not met - only 2 signs/symptoms in IWP (Table 1, p. 6-6, PNEU chapter):
  - Leukocytosis/fever
  - Rales
  - At least one additional s/s needed

Case Study #2

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	PNEU Elements
1	Imaging: opacities
2	Imaging: pulmonary edema
3	Leukocytosis
4	Imaging: opacities, likely pulmonary edema
5	Imaging: increasing opacities, pulmonary edema vs. developing pneumonia
6	Imaging: opacities reflect pneumonia BAL culture: 4+ growth *E. coli* Worsening gas exchange
7	Blood culture: *S. aureus*
8	
9	Imaging: opacities reflect pneumonia
10	
11	Imaging: opacities reflect pneumonia

Case Study #2 – Answer, part 1

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	PNEU Elements
1	Imaging: opacities
2	Imaging: pulmonary edema
3	Leukocytosis
4	Imaging: opacities, likely pulmonary edema
5	Imaging: increasing opacities, pulmonary edema vs. developing pneumonia
6	Imaging: opacities reflect pneumonia BAL culture: 4+ growth *E. coli* Worsening gas exchange
7	Blood culture: *S. aureus*
8	
9	Imaging: opacities reflect pneumonia
10	
11	Imaging: opacities reflect pneumonia

- **Imaging requirement is met**
- Day 5 imaging test – worsening equivocal evidence of pneumonia
- Day 6 imaging test – clarifies equivocal findings to be pneumonia
- Day 9 and 11 imaging tests – persistent evidence of pneumonia
- Day 5 imaging test is first positive diagnostic test for meeting PNEU and sets a PNEU IWP from Day 2 – Day 8

Case Study #2 – Answer, part 2

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	PNEU Elements
1	Imaging: opacities
2	Imaging: pulmonary edema
3 DOE	Leukocytosis
4	Imaging: opacities, likely pulmonary edema
5	Imaging: increasing opacities, pulmonary edema vs. developing pneumonia
6	Imaging: opacities reflect pneumonia BAL culture: 4+ growth *E. coli* Worsening gas exchange
7	Blood culture: *S. aureus*
8	
9	Imaging: opacities reflect pneumonia
10	
11	Imaging: opacities reflect pneumonia

- **PNU2 is met with the Day 6 BAL**
- **PNU2 is met with the Day 7 BC**
- **PNEU DOE is HD 3**
  - **BSI is secondary to PNEU**
  - **Pathogens are *E. coli* and *S. aureus***
- When a criterion can be met with both blood and site-specific specimens as elements in the IWP, the organisms do not have to match (BSI chapter, p. 4-32 and 4-33)

Case Study #3

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	PNEU Elements
1	Fever >38.0°C
2	Tachypnea, rales
3	
4	Imaging: New infiltrate
5	Fever >38.0°C
6	
7	Imaging: Infiltrate
8	
9	Imaging: Infiltrate
10	
11	Fever >38.0°C
12	BC: *P. aeruginosa*
13	Imaging: Infiltrate; dyspnea
14	

Case Study #3 – Answer, part 1

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	SBAP	RIT	IWP
1	DOE	1	Fever >38.0°C
2		2	Tachypnea, rales
3		3	
4		4	Imaging: New infiltrate
5		5	Fever >38.0°C
6		6	
7		7	Imaging: Infiltrate
8		8	
9		9	
10		10	
11		11	Fever >38.0°C
12	BC+	12	BC: *P. aeruginosa*
13		13	Imaging: Infiltrate; dyspnea
14		14	

- **Imaging requirement is met**
  - Day 4 – new findings
  - Days 7 & 12 – persistent findings
- PNEU IWP: HD 1 - 7
- **PNU1 is met**
  - PNEU DOE: HD 1
  - PNEU SBAP: HD 1-14
  - PNEU RIT: HD 1-14

Case Study #3 – Answer, part 2

Can the blood culture be assigned as a secondary BSI to PNEU?

HD	SBAP	RIT	IWP
1	DOE	1	Fever >38.0°C
2		2	Tachypnea, rales
3		3	
4		4	Imaging: New infiltrate
5		5	Fever >38.0°C
6		6	
7		7	Imaging: Infiltrate
8		8	
9		9	
10		10	
11		11	Fever >38.0°C
12	BC+	12	BC: *P. aeruginosa*
13		13	Imaging: Infiltrate; dyspnea
14		14	
15			

- A BSI cannot be secondary to PNU1
- If PNU2 can be met with the BC as an element in a new IWP, the BSI can be determined secondary to PNEU
- When re-meeting PNEU in the PNEU RIT, persistent imaging findings are sufficient
- Day 12 BC sets a PNEU IWP HD 9-15
- **PNU2 met with DOE HD 11**
- Day 12 BC assigned as a secondary BSI to the original HD 1 PNEU event
- See PNEU FAQ #10 https://www.cdc.gov/nhsn/faqs/faq-pneu.html

For NHSN questions or concerns, contact the NHSN Helpdesk

- **NHSN-ServiceNow** to submit questions to the NHSN Help Desk.
- Access new portal at **https://servicedesk.cdc.gov/nhsncsp** .
- If you do not have a SAMS login, or are unable to access ServiceNow, you can still email the NHSN Help Desk at nhsn@cdc.gov.

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