Pneumonia and Ventilator-Associated Pneumonia Surveillance

Last Updated 2019
Objectives

• Describe surveillance definitions for pneumonia (PNEU), ventilator associated events (VAE), and possible ventilator associated pneumonia (PVAP)
• Demonstrate how to use the NHSN VAE Calculator
• Review importance of feedback of HAI results to staff
Pneumonia (PNEU) Surveillance Definition

• NHSN PNEU definition is used for non-ventilated patients only
• Surveillance definition can be met by 3 different criteria using combinations of imaging, signs/symptoms of infection, and laboratory results
  • Clinically defined pneumonia (PNU1)
  • Pneumonia with specific laboratory findings (PNU2)
  • Pneumonia in immuno-compromised patients (PNU3)
Pneumonia (PNEU) with Secondary BSI

• Used frequently for CLABSI surveillance to determine if BSI is primary or secondary to pneumonia
  • Candida and other yeast are not considered causative pathogens of pneumonia
Identifying Ventilator-Associated Events (VAE) and Possible Pneumonia (PVAP)

• Follow NHSN surveillance protocols
• Work with ICU and respiratory therapy staff to develop alerting process
• Monitor ventilated patient for
  • Positive cultures
  • Changes in WBC
  • Patient temperature chart/log
  • Pharmacy reports of antimicrobial use
  • Change in respiratory secretions
Defining VAE and PVAP

- Pneumonia definition is subjective and complex
- Surveillance definition algorithm detects a broad range of conditions/complications that occur in mechanically ventilated patients
- Ventilator-associated event (VAE) defines
  - Ventilator-associated conditions (VAC)
  - Infection-related ventilator-associated complications (IVAC)
  - Possible ventilator-associated pneumonia (PVAP)
Applying VAE and Pneumonia Surveillance Definitions

• **VAE** definition is used for all ventilated patients in adult locations regardless of age (excludes high frequency ventilated and extracorporeal life support patients)
  • IVAC is an infection-related VAE
  • IVAC/PVAP is pneumonia that occurs in patients intubated and on mechanical ventilation
• **VAP/PNEU** definition is used for pediatric locations
  • Includes pediatric locations (e.g., PICU)
  • Excludes NICU

NHSN Patient Safety Module: Chapter 10
VAE/PVAP Surveillance Definition

• Patient must be ventilated >2 calendar days
• Patient must have ≥3 calendar days of stability or improvement of oxygenation followed by ≥2 calendar days of worsening oxygenation
• Earliest date of event for VAE is mechanical ventilation day 3 (first day of worsening oxygenation)
• First possible day that VAC criteria can be fulfilled is mechanical ventilation day 4
• For VAE surveillance, PEEP values between 0 - 5 cmH2O will be considered equivalent

NHSN Patient Safety Module: Chapter 10
Ventilator Associated Event (VAE)

- Daily minimum PEEP and FiO₂ values are defined as the lowest value set on the ventilator during a calendar day (and maintained for at least 1 hour)
  - If there is no value documented to have been maintained for at least 1 hour, the daily minimum value is the lowest value set on the ventilator during the calendar day
- VAE optional denominator – episodes of mechanical ventilation (EMV)
  - An episode of mechanical ventilation is a period of days during which the patient was mechanically ventilated for some portion of each consecutive day
VAC Criteria

• A baseline period of stability or improvement on the ventilator, defined by ≥2 calendar days of stable or decreasing daily minimum FiO₂ or PEEP

• The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO₂

  AND

• After the period of stability – At least 1 of the following 2 criteria sustained for ≥2 calendar days:
  
  1. Increase in daily minimum FiO₂ of ≥20 points over the daily minimum FiO₂ in the baseline period
  
  2. Increase in daily minimum PEEP of ≥3 cmH₂O
IVAC Criteria

• Meets VAE criteria for VAC

  AND

• On or after calendar day 3 on ventilator and within 2 calendar days before or after onset worsening oxygenation:

• BOTH of the following 2 criteria are met:
  ❑ 1. Temp >38°C or <36°C
      OR
      WBC>12,000 cells/mm³ or <4,000 cells/mm³
  ❑ 2. A new antimicrobial agent(s) is started, and is continued for >4 calendar days

NHSN Patient Safety Module: Chapter 10
PVAP Criteria

- Meets VAE criteria for IVAC
- On or after calendar day 3 on ventilator and within 2 calendar days before or after onset of worsening oxygenation:

  **One** of the following three criteria is met:

  - 1. Positive culture (see list) without requirement for purulent respiratory secretions*
  - 2. Purulent respiratory secretions **plus** specified positive respiratory culture*
  - 3. Positive pleural culture, lung histopathology, or diagnostic test for Legionella, or specified virus*

*Consult VAE protocol for organism exclusions

NHSN Patient Safety Module: Chapter 10
1. Enter ventilator data, follow instructions

### NHSN VAE Calculator Version 5.0

<table>
<thead>
<tr>
<th>MV Day</th>
<th>Date</th>
<th>Min. PEEP (cmH₂O)</th>
<th>Min. FiO₂ (20 - 100)</th>
<th>VAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9/7/2017</td>
<td>5</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9/8/2017</td>
<td>5</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/9/2017</td>
<td>5</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9/10/2017</td>
<td>5</td>
<td>100</td>
<td>VAC</td>
</tr>
<tr>
<td>5</td>
<td>9/11/2017</td>
<td>8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9/12/2017</td>
<td>8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>9/13/2017</td>
<td>8</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>9/14/2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9/15/2017</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Meets VAC Criteria. “Go to IVAC”

[VAE Calculator](https://www.cdc.gov/nhsn/vae-calculator/index.html)
2. Enter temperature, WBC count, antibiotics

3. Click “Calculate IVAC”
The event on 9/10/2017 conforms to a Possible Ventilator-Associated Pneumonia (PVAP) definition. For a discussion of why, click on the Explain button.

1. Check off criteria in table, then “Calculate PVAP”

2. Result:
   - After calculating PVAP, a pop up will appear verifying the type of event.
   - Select Explain for information on the criteria used.

PVAP Determination
For the IVAC on 9/10/2017, did the patient have documentation of any of the following findings during the VAE Window: 9/9/2017 to 9/12/2017.

Question
Criterion 1. Positive culture of one of the following (without requirement for purulent respiratory secretions):
- Endotracheal aspirate ≥ 10^6 cfu/ml
- Bronchoalveolar lavage ≥ 10^6 cfu/ml
- Lung tissue ≥ 10^6 cfu/ml
- Protected specimen brush ≥ 10^6 cfu/ml
*or corresponding semi-quantitative result

Criterion 2. Positive culture of one of the following (qualitative or quantitative/semi-quantitative culture without sufficient growth to meet Criterion 1):
- Sputum
- Endotracheal aspirate
- Bronchoalveolar lavage
- Lung tissue
- Protected specimen brush

ARP
Evidence of purulent respiratory secretions (defined as secretions from lungs, bronchi or trachea that contain ≥ 25 neutrophils and ≤ 10 squamous epithelial cells).

Criterion 3. One of the following positive tests (as outlined in the protocol):
- Pleural fluid culture
- Lung histopathology
- Diagnostic test for Legionella species
- Diagnostic test for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus or coronavirus.

Start Over Explain... Go to PVAP

Criterion 1 is checked. Clicking "Yes" to any of the three criteria is sufficient to meet the definition of a Possible Ventilator-Associated Pneumonia (PVAP) for the event on 9/10/2017.

(Hint: this box is movable by dragging with your mouse. If you move it to one side and leave it open, the explanation will automatically update itself as things change.)

[OK]
Report Monthly VAE Summary Data

- Enter monthly denominator data for each patient location
  - Patient days
  - Ventilator line days
Enter VAE Event

- Add VAE Events as they occur
- Collect criteria meeting definition to enter into NHSN
- NHSN has a worksheet available for data collection
- Use VAE Calculator
NHSN VAE Analysis

- Generate data set prior to creating a report
- Choose report according to need
  - SIR report - Your incidence compared to expected incidence
  - SUR report - Your ventilator usage compared to expected
Feedback VAE Results

• Share VAE SIR and SUR progress results with
  • ICU staff
  • ICU Committee
  • Infection Control Committee
  • Leadership
• Analysis of your data helps identify areas for further education and prevention activities
Pneumonia Surveillance Summary

- Surveillance for pneumonia and VAP challenging
- VAE definitions reduce variability
  - Used only in adult locations
- Consistent use of standard surveillance methods and PNEU/VAE/VAP definitions are essential for accurate case finding
- Analysis and feedback of VAE/VAP data is necessary to review progress in VAE/VAP reduction
References for VAP Prevention and Bundles

• Institute for Healthcare Improvement (IHI)
  http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx

• SHEA Compendium: Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update
References and Resources


- Chapter 10(VAE) [http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf](http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf)
Questions?

For more information, please contact any HAI Liaison IP Team member

Or email HAIProgram@cdph.ca.gov