A New, National Approach to Surveillance for Ventilator-associated Events; Challenges and Opportunities

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Nov. 20, 2013
Objectives

- Define the new VAE definition
- Describe various ways to implement the VAE Definition
- Identify evidence based practices for prevention
- Explain ways in which case assessment can lead to opportunities for improvement.
The true incidence of VAP is difficult to determine

Traditional surveillance definitions are highly subjective

Chest x-ray interpretations variable

Klompas ;Crit Care Med 2012 Vol. 40, No. 12
Difficulty in Applying the Previous Definition

Moderate right pleural effusion with possible overlying pneumonia

Opacities in lower lobe may be atelectasis, pneumonia or emphysematous changes

Pleural effusion or atelectasis however, pneumonia cannot be rule out

Bibasilar changes which may represent atelectasis, pneumonia or edema
Interobserver Agreement in VAP Surveillance

50 ventilated patients with respiratory deterioration

IP 1 (11 VAPs)

IP 2 (20 VAPs)

IP 3 (15 VAPs)

Kappa = 0.40

Klompas, AJIC 2010:38:237
Differences in NYS among IPs Collecting VAP Data

- Must be vetted with Physicians
- Start with sputum specimen
- Daily rounding
- Daily review of CXR
- Determination by ICU Staff
<table>
<thead>
<tr>
<th>Component</th>
<th>Condition/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory status component</td>
<td>Patient on mechanical ventilation &gt; 2 days</td>
</tr>
<tr>
<td></td>
<td>Baseline period of stability or improvement, followed by sustained period of worsening oxygenation</td>
</tr>
<tr>
<td>Infection / inflammation</td>
<td>Ventilator-Associated Condition (VAC)</td>
</tr>
<tr>
<td></td>
<td>General evidence of infection/inflammation</td>
</tr>
<tr>
<td>Additional evidence</td>
<td>Infection-Related Ventilator-Associated Complication (IVAC)</td>
</tr>
<tr>
<td></td>
<td>Positive results of microbiological testing</td>
</tr>
<tr>
<td></td>
<td>Possible or Probable VAP</td>
</tr>
</tbody>
</table>
VAE Surveillance Definition Algorithm Summary

- **Respiratory status component**
  - Patient on mechanical ventilation > 2 days
  - Baseline period of stability or improvement, followed by sustained period of worsening oxygenation
  - Ventilator-Associated Condition (VAC)

- **Infection / inflammation component**
  - General evidence of infection/inflammation
  - Infection-Related Ventilator-Associated Complication (IVAC)

- **Additional evidence**
  - Positive results of microbiological testing
  - Possible or Probable VAP

FiO₂ or PEEP
VAE Surveillance Definition Algorithm Summary

- **Respiratory status component**
  - Patient on mechanical ventilation > 2 days
  - Baseline period of stability or improvement, followed by sustained period of worsening oxygenation
  - **Ventilator-Associated Condition (VAC)**
    - General evidence of infection/inflammation
      - Temperature or WBC and New antimicrobial agent

- **Infection / inflammation component**
  - **Infection-Related Ventilator-Associated Complication (IVAC)**
    - Positive results of microbiological testing
      - Possible or Probable VAP

- **Additional evidence**
VAE Surveillance Definition Algorithm Summary

- **Respiratory status component**
  - Patient on mechanical ventilation > 2 days
  - Baseline period of stability or improvement, followed by sustained period of worsening oxygenation
  - Ventilator-Associated Condition (VAC)

- **Infection / inflammation component**
  - General evidence of infection/inflammation
  - Infection-Related Ventilator-Associated Complication (IVAC)

- **Additional evidence**
  - Positive results of microbiological testing
  - Possible or Probable VAP

- Purulent secretions and/or other positive laboratory evidence
**VAE Surveillance Definition Algorithm Summary**

- **Respiratory status component**
  - Patient on mechanical ventilation > 2 days
  - Baseline period of stability or improvement, followed by sustained period of worsening oxygenation

- **Infection / inflammation component**
  - Ventilator-Associated Condition (VAC)
    - General evidence of infection/inflammation
      - Infection-Related Ventilator-Associated Complication (IVAC)

- **Additional evidence**
  - Positive results of microbiological testing
    - Possible or Probable VAP

- **Purulent secretions and/or other positive laboratory evidence**
The Burning Question

- Why are we making the switch?
- How important is this change?
The New Definition: Challenges

- Implementation

- How do we apply the definition?

- How do we get “buy in” from key stakeholders?

- How do we interpret data- not all VACs are preventable?
Getting Started

Engage

Evaluate

Educate

Execute
Engage

- Form Multidisciplinary Team
- Identify Local Champions
- Use Peer Networks
# Reasons for Stakeholder Engagement

<table>
<thead>
<tr>
<th>Infection Preventionists</th>
<th>Respiratory Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduce inter-rater variation</td>
<td>• “Connects the dots “</td>
</tr>
<tr>
<td>• Minimum amount of time on the vent (elimination of- there is no minimum period of time that the ventilator is in place for pneumonia to be considered)</td>
<td>• Relies heavily on their knowledge and expertise</td>
</tr>
<tr>
<td>• No more chest x-rays</td>
<td>• Establishes them as important member of the prevention team</td>
</tr>
<tr>
<td>• Potential to drive interventions</td>
<td>• Possible ability to intervene earlier</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intensivists</th>
<th>Critical Care Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Infectious and non – infectious complications</td>
<td>• Looks at the entire patient picture</td>
</tr>
<tr>
<td>• Clinically credible</td>
<td>• Potential for earlier intervention</td>
</tr>
<tr>
<td>• Fosters collaboration</td>
<td>• Fosters atmosphere of team work and collaboration</td>
</tr>
</tbody>
</table>
## Reasons Continued

<table>
<thead>
<tr>
<th>ID Physicians</th>
<th>Pharmacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Clinical credibility</td>
<td>• Antibiotic treatment highlighted</td>
</tr>
<tr>
<td>• No minimum time on the vent</td>
<td>• Potentially fosters antibiotic stewardship</td>
</tr>
<tr>
<td>• Incorporates antibiotic treatment</td>
<td></td>
</tr>
<tr>
<td>• “Connect the dots”</td>
<td>• Gives a more completed picture of the patient</td>
</tr>
<tr>
<td>• Objective</td>
<td></td>
</tr>
</tbody>
</table>
Welcome to Version 2 of the VAE Calculator. Version 2 operates based upon the currently posted (July 2013) VAE protocol. The Calculator is a web-based tool that is designed to help you learn how the VAE surveillance definition algorithm works and assist you in making VAE determinations. Please note that the Webinars with Case Studies
• VAE Case Studies
Execute Various Approaches

At hospital x, the data is kept at the bedside, the chart is reviewed during multidisciplinary rounds, and the care team fills in any new information in addition to ventilator settings. This information provides important details to clinicians, and helps drive their treatment plan since vent settings, WBC, temp and culture data can be reviewed simultaneously. The team also assesses process measures such as sedation vacation and ventilator weaning at that time.
## Execute- Patient Data

<table>
<thead>
<tr>
<th>Vent Day</th>
<th>PEEP min</th>
<th>FiO₂</th>
<th>Temp</th>
<th>WBC</th>
<th>Anti-micro agent</th>
<th>Micro source</th>
<th>Polys</th>
<th>Epis</th>
<th>Organism</th>
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<tbody>
<tr>
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<td>10</td>
<td>50</td>
<td>37.5</td>
<td>11.6</td>
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<td>2</td>
<td>5</td>
<td>50</td>
<td>37.8</td>
<td>11.8</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>50</td>
<td>37.8</td>
<td>12.0</td>
<td>none</td>
<td>ETA</td>
<td>3+</td>
<td>0</td>
<td><em>s.aureus</em></td>
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<td>4</td>
<td>8</td>
<td>70</td>
<td>38.2</td>
<td>15.0</td>
<td>PIPTAZ Vanco</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>8</td>
<td>60</td>
<td>38.5</td>
<td>14.2</td>
<td>PIPTAZ Vanco</td>
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<td>38.0</td>
<td>12.9</td>
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<td>5</td>
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<td>11.8</td>
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<td></td>
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<tr>
<td>8</td>
<td>5</td>
<td>40</td>
<td>37.6</td>
<td>11.6</td>
<td>none</td>
<td>ETA</td>
<td>1+</td>
<td>1+</td>
<td><em>Oral flora</em></td>
</tr>
</tbody>
</table>
What are the take home messages in trying to get there?

Implementation Science – How do we get evidence to the bedside?

We have to take a closer look at processes
Other Approaches

- Respiratory therapy fills out surveillance log for VAE whenever patient meets criteria for VAC and alerts IP and pharmacy.
- ICU pharmacist collaborates with respiratory therapy and IP and alerts team when new medications are started.
- IP reviews additional lab and micro data and determines if the VAC meets the IVAC and possible or probable VAP definition.
- IP collaborates with the team.
# VAE (Ventilator Associated Event) Monitor

**For started:** Ventilation start date

<table>
<thead>
<tr>
<th>Step 1: VAC (change in A or B)</th>
<th>Step 2: IVAC (VAC, plus C or D, and E)</th>
<th>Step 3: Possible VAP (IVAC, plus F or G) - OR - Probable VAP (IVAC, plus F and Gii) or IVAC, plus H</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C. Temp</td>
</tr>
<tr>
<td>KEAP min</td>
<td>FIO2 min</td>
<td>Min (&lt;36°C)</td>
</tr>
</tbody>
</table>

**Patient Sticker**
Other Examples

Transition form VAP to VAE

- VAE CBT for All CC, RT, and IP staff
- Team VAE Surveillance in 2/4 ICUs
- Team VAE Surveillance 4/4 ICUs
- Share VAE data with CDC NHSN

- Oct 2012
  - Monthly and prn Meetings with Team

- Jan 2013
  - IP Staff transition at desk to all ICUs

- Jun 2013
  - Temporary IT Solution for PEEP and FiO2 monitoring

- Jul 2013
  - Share VAE data with Quality Organizations

- Jan 2014
Communicating VAE Surveillance

- RT rounds at 12am/fax potential VAE to IP and notify Critical Care Coordinators
- VAE confirmed by team
- VAE added to “white board” in CC Staff area
- Attention to bundles, overall patient condition
- Review of process for improvement at Interdisciplinary VAE meeting and via email
Cases

A 72 year old female is intubated in the ICU and remains ventilated for the next several days.

<table>
<thead>
<tr>
<th>DAY</th>
<th>Daily Min. PEEP</th>
<th>Daily Min FiO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/28/13</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>04/29/13</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>04/30/13</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>05/01/13</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>05/02/13</td>
<td>6</td>
<td>40</td>
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<tr>
<td>05/03/13</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>05/04/13</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>05/06/13</td>
<td>5</td>
<td>60</td>
</tr>
</tbody>
</table>
Now enter PEEP or FiO₂ values and when done, click the "Calculate VAC" button. **You do not need to enter data for every day.** Concentrate on the dates where you believe a Ventilator-Associated Event may be likely. If your values meet the Ventilator-Associated Condition (VAC) definition, the event day will be identified and the VAE Window will be defined.

<table>
<thead>
<tr>
<th>MV Day</th>
<th>Date</th>
<th>Min. PEEP (cmH₂O)</th>
<th>Min. FiO₂ (%21-100)</th>
<th>VAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4/29/2013</td>
<td>8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4/30/2013</td>
<td>6</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5/1/2013</td>
<td>5</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5/2/2013</td>
<td>6</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5/3/2013</td>
<td>6</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5/4/2013</td>
<td>6</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>5/5/2013</td>
<td>5</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5/6/2013</td>
<td>5</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>5/7/2013</td>
<td>5</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5/8/2013</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5/10/2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>5/11/2013</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Ventilator-Associated Condition (VAC) was found on day 5/4/2013. Click on the "Go To IVAC" button to move the the next part of the protocol or click on the "Explain" button to see how this determination was made.

There is a baseline period of stability or improvement of FiO₂ on days 5/2/2013 and 5/3/2013. This is followed by two consecutive days of worsening oxygenation where the values are 20% or more above the period of stability. The date of the VAC is set to the first day of worsening after the baseline period.

(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.)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>5/4/2013</td>
<td>6</td>
<td>60</td>
<td>VAC</td>
</tr>
<tr>
<td>7</td>
<td>5/5/2013</td>
<td>5</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5/6/2013</td>
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<td>5</td>
<td>60</td>
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</tr>
<tr>
<td>10</td>
<td>5/8/2013</td>
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<tr>
<td>11</td>
<td>5/9/2013</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5/10/2013</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Case Review

A 67 year old man intubated in ED post cardiac arrest. Admitted to MICU intubated and on ventilator.

- Chest x-ray on day 2 shows infiltrate suggestive of pneumonia. Day 3 progressive infiltrate.
- Sputum – < 10 epithelial cells
  > 25 WBC
- Culture 2+ Staph Aureus
<table>
<thead>
<tr>
<th>Day</th>
<th>PEEP</th>
<th>FiO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
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<tr>
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<td>6</td>
<td>40</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>40</td>
</tr>
</tbody>
</table>
No VAE detected. Click on the "Explain" button to see an explanation of the VAC definition.

<table>
<thead>
<tr>
<th>MV Day</th>
<th>Date</th>
<th>Min. PEEP (cmH₂O)</th>
<th>Min. FiO₂ (% 21-100)</th>
<th>VAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2/25/2013</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
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<td>2/26/2013</td>
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<td>30</td>
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</tr>
<tr>
<td>3</td>
<td>2/27/2013</td>
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<td>10</td>
<td>3/6/2013</td>
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<td>40</td>
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</tr>
</tbody>
</table>

For a VAE to be present there must be two consecutive days of steady or declining PEEP or FiO₂ values followed by two consecutive days of worsening condition where the PEEP value increases by 3 cmH₂O or more or the FiO₂ values increase by 20% or more above the base period.

(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.)
### All Events

<table>
<thead>
<tr>
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<th>summaryYQ</th>
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<th>vaecount</th>
<th>numventdays</th>
<th>vaeRate</th>
<th>numpatdays</th>
<th>VentDU</th>
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<tbody>
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<td>ICU</td>
<td>2013Q1</td>
<td>3</td>
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<tr>
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<td>9</td>
<td>618</td>
<td>14.563</td>
<td>1036</td>
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### VAC

<table>
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### IVAC

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<th>vaeRate</th>
<th>numpatdays</th>
<th>VentDU</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU</td>
<td>2013Q1</td>
<td>3</td>
<td>0</td>
<td>628</td>
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<td>3</td>
<td>2</td>
<td>618</td>
<td>3.236</td>
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<td>0.597</td>
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### POVAP

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<td>2</td>
<td>628</td>
<td>3.185</td>
<td>993</td>
<td>0.632</td>
</tr>
<tr>
<td>ICU</td>
<td>2013Q2</td>
<td>3</td>
<td>0</td>
<td>618</td>
<td>0.000</td>
<td>1036</td>
<td>0.597</td>
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</table>

### PRVAP

<table>
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<tr>
<th>location</th>
<th>summaryYQ</th>
<th>months</th>
<th>vaecount</th>
<th>numventdays</th>
<th>vaeRate</th>
<th>numpatdays</th>
<th>VentDU</th>
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</thead>
<tbody>
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<td>628</td>
<td>0.000</td>
<td>993</td>
<td>0.632</td>
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<td>ICU</td>
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<td>0</td>
<td>618</td>
<td>0.000</td>
<td>1036</td>
<td>0.597</td>
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What can we learn from VAC?

Drilling down on VAC Cases

<table>
<thead>
<tr>
<th>eventType</th>
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<th>location</th>
<th>patID</th>
<th>patgname</th>
<th>patsurname</th>
<th>spcEvent</th>
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</thead>
<tbody>
<tr>
<td>VAE</td>
<td>F</td>
<td>ICU</td>
<td>1234</td>
<td>Mickey</td>
<td>Mouse</td>
<td>POVAP</td>
</tr>
<tr>
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<td>F</td>
<td>ICU</td>
<td>5678</td>
<td>Donald</td>
<td>Duck</td>
<td>POVAP</td>
</tr>
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<td>VAE</td>
<td>F</td>
<td>ICU</td>
<td>2222</td>
<td>Charlie</td>
<td>Brown</td>
<td>VAC</td>
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<td>F</td>
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<td>VAE</td>
<td>M</td>
<td>ICU</td>
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<td>Bugs</td>
<td>Bunny</td>
<td>VAC</td>
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<tr>
<td>VAE</td>
<td>M</td>
<td>ICU</td>
<td>5555</td>
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<td>Man</td>
<td>VAC</td>
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<tr>
<td>VAE</td>
<td>F</td>
<td>ICU</td>
<td>6666</td>
<td>Spider</td>
<td>Woman</td>
<td>VAC</td>
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</table>
### Multivariate Analysis – Risk Factors for VAC

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II score</td>
<td>0.92 (0.82, 1.04)</td>
<td>0.17</td>
</tr>
<tr>
<td>Hospital days to ICU admission</td>
<td>1.09 (0.99, 1.20)</td>
<td>0.09</td>
</tr>
<tr>
<td>% ventilator days with SBTs</td>
<td>0.97 (0.94, 1.01)</td>
<td>0.10</td>
</tr>
<tr>
<td>% ventilator days with SATs</td>
<td>0.93 (0.87, 1.00)</td>
<td>0.05</td>
</tr>
<tr>
<td>% ventilator days with CHG oral care</td>
<td>1.02 (0.99, 1.04)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Klompas et al., IDWeek 2012; Abstract 1232
Is VAC Preventable?

- Evidence to suggest that VAC is a complication rather than just a marker for severity of illness.

- Evidence that most are acquired ICU conditions such as Pneumonia, ARDS, PE and atelectasis.
Prevention of VAEs: What do We Know?

- Most important knowledge gap
- Patients who have VAC do worse than patients who do not have VAC
- Need to know more about IVAC, Possible and Probable VAP
- VAC definition detects important clinical conditions
- More work to be done for IVAC, Possible and Probable VAP
- Emerging evidence that VAC rates may be responsive to evidence-based interventions in mechanically-ventilated patients

* More evidence needed
Early Evidence

Canadian Critical Care Trial

Retrospective Study (applied VAC Definition to previous data collected on adherence to Guidelines)

Found that when adherence increased VAC rates decreased
What about patient care processes?

- Existing literature on VAP prevention is based on traditional VAP definitions rather than on VAE definitions.
- No data at present to identify how traditional VAP prevention strategies impact “Probable Pneumonias”.
- Interventions designed to shorten the duration of mechanical ventilation in general should decrease VAE rates but has not been formally tested.
- Existing VAP prevention literature is the best available guide to improving outcomes for ventilated patients.
## Bundle Elements

### The Basic Bundle

<table>
<thead>
<tr>
<th>Element</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>HOB Monitoring</td>
<td>Low cost. Benefit unknown. Important with tube feeding</td>
</tr>
<tr>
<td>Weaning</td>
<td>Decreasing duration of ventilation. Suggestive evidence</td>
</tr>
<tr>
<td>PUD Prophylaxis</td>
<td>Not related to VAP</td>
</tr>
<tr>
<td>DVT prophylaxis</td>
<td>Not related to VAP</td>
</tr>
</tbody>
</table>

### Enhanced Bundle

<table>
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<th>Element</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth Care</td>
<td>Chlorohexidine vs. regular mouth care</td>
</tr>
<tr>
<td>Education and Training Program</td>
<td></td>
</tr>
<tr>
<td>New Generation ET tubes</td>
<td>Need more studies. No impact on LOS or mortality</td>
</tr>
<tr>
<td>Oral gastric tubes</td>
<td></td>
</tr>
<tr>
<td>Ambulation</td>
<td>Evidence supports</td>
</tr>
</tbody>
</table>
Ambulation

Early intensive care unit mobility therapy in the treatment of acute respiratory failure.

Intensive care mobility team

**Protocol patients:**
- Were out of bed earlier (5 vs. 11 days, \( p < \text{or} = 0.001 \)),
- Had therapy initiated more frequently in the intensive care unit (91% vs. 13%, \( p < \text{or} = 0.001 \))
- Had low complication rates compared with Usual Care.
- (Protocol patients, intensive care unit length of stay was 5.5 vs. 6.9)

Intensive Care Progressive Mobility Guidelines

Goal of Early Mobilization:
- Promote mechanical ventilator weaning process
- Reduce ICU and Hospital LOS
- Prevent physical deconditioning
- Prevent Ventilator-Associated Pneumonia (VAP)
- Prevent Pressure Ulcers
- Maintain/achieve preadmission activity level
- Enhance patient physical and psychological well-being

Monitor for Physical Therapy / Occupational Therapy Consult:
- OT consult on admission, then weekly follow-up evaluation
- PT consult when patient is able to cooperate with activity of begins SDT (Spontaneous Breathing Trials)

Document all Mobility on Flow Sheet

Level I Modified Mobility Process
Criteria: Admission to Intensive Care Unit or Progressive Care Unit
- Reposition and Turn Q 2 Hrs
- AROM/FROM
- Splints and/or boots (alternate for contracture prevention)
- HOB @ 30 degrees

Advance mobility using progressive Algorithm Level as Pt. tolerates. Reassess q 12 hours
Exclusion criteria for advancing mobility level:
- Lobar collapse or atelectasis, excessive secretions and/or:
  - FiO2 ≥ 50% with PEEP ≥ 10
  - SaO2 ≤ 90% at rest or ≤ 88% with activity
- Progressively deteriorating neurological status
- Severe orthopaedic problems
- Hemodynamic instability (MAP, HR)

Hemodynamic Tolerance
5-10 minutes equilibration time is required with each position change to determine hemodynamic instability

Level II (Include Level I Interventions)
- HOB @ 45° to 65° if hemodynamically stable
- Place legs in dependent position
- Advance to Cardiac Chair
- OOB to Chair with assistive device (2x Daily for 1 hr)
- Time frame for OOB in Chair positioning is ≤1 hr

If PT has large abdomen try a lesser HOB angle when in sitting position

Level III (Include Level I & II Interventions)
- Sit on Side of Bed
- Advance to Standing Position
- Initiate Pivot / Stand to side/side chair @ least 2 x Daily

Level IV (Include Level I, II & III Interventions)
- Independent: OOB, Sit in Chair, Stand, Ambulate

Adapted from:
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Sandy Czarnecki, Czarneki@urmc.rochester.edu
Other Preventative Measures

- Avoid intubation
- Assess readiness to extubate
- Provide routine oral care
- Use cuffed ET tube
- Prevent condensate
- Subglottic secretion
Non-Invasive Ventilation Guidelines (CPAP or BIPAP)

PURPOSE:
Non-Invasive Positive Pressure Ventilation (NPPV) is positive pressure applied to the upper airway via a nasal or full-face mask for the purpose of augmentation of alveolar ventilation. The NPPV Guidelines will be initiated upon receipt of any order for CPAP (Continuous Positive Airway Pressure) or BIPAP (Bi-level Positive Airway Pressure). Upon receipt of the physician’s order the patient will be assessed by the Respiratory Therapist. Patient assessment data will be used to establish the indications for NPPV and to determine the level of support that will be provided. Patients who meet criteria for NPPV will be classified into 2 groups to determine clinical settings and to monitor the level of NPPV: Acute Respiratory Failure and Chronic Hypoventilation/Obsnstructive Sleep Apnea.

INDICATIONS/CLINICAL SETTING
Acute Respiratory Failure
• Blood gas findings
  o Partial pressure of carbon dioxide in arterial gas (PaCO₂) greater than 45 mm Hg
  o pH less than 7.35 but more than 7.10
  o PaO₂ to fraction of inspired oxygen (FiO₂) ratio less than 200

• Clinical inclusion criteria
  o Signs or symptoms of acute respiratory distress
  o Moderate-to-severe dyspnea, increased over baseline
  o Respiratory rate greater than 24 breaths per minute
  o Accessory muscle use
  o Abdominal paradox
  o Gas exchange disorders
  o PaCO₂ greater than 45 mm Hg and pH less than 7.35
  o PaO₂ to-FiO₂ ratio less than 200 mm Hg

• Diagnosis
  o COPD exacerbation
  o Acute pulmonary edema
  o Pneumonia

• Clinical Setting
  o Patients requiring NPPV for acute respiratory failure can be admitted on any floor. Initiation of BIPAP does not require an ICU admission. However, an ABG will be checked within one hour after BIPAP is started. If there is no clinical improvement and/or the ABG shows persistent acidosis, the ICU will be consulted to assess the need for transfer to the ICU or W5.
Prevention Thoughts

- Prevention of Pneumonia - HOB
- Pulmonary - Fluid conservation
- Atelectasis – manage sedation
- Acute lung injury - low tidal volume
Managing Sedation

- Wake up and breathe trials- Lancet 2008 (RCT)
- Awakening and Breathing Controlled (ABC) trial
- **Intervention Arm**- paired “wake up and breathe” protocol (pairs reduction of sedatives with daily spontaneous breathing trials)
- **Control Arm**- Usual sedation protocol

Lancet 2008 Jan 12;371(9607):126-34
Results

Intervention group:

- Spent three fewer days on the ventilator
- Less time in the CU (9.1 days vs. 12.9)
- Had reduced lengths of hospital stay (14.9 days vs. 19.2)
- Had lower one-year mortality.
Case Study VAE

- Ms. X is a 26 y.o. vent dependent patient. She has a history of anoxic brain injury and is admitted with pneumonia from a long term care facility (LTCF).
- She is placed on antibiotics and after 4 days has stabilized on the vent. She is improving clinically and the plan is to return to the LTCF.
- On day 7, she has a significant event and a sustained period of worsening oxygenation.
- She meets definition for VAE.
The clinicians have identified that her event was caused by a mucus plug.

What do we do next?
The Analysis

- Changes in Nurses and Respiratory Therapy staff - no documentation of secretions
- Failure to notice thickened secretions and change in color of secretions
- Although Patient was at baseline – did not get her up into a chair
- Patient was dehydrated
Learn from Defects Tool Worksheet

Date:

Attendees: patient safety team  Topic: VAE

What happened? (brief description)
Patient developed mucus plug and difficult ventilation

Why did it happen? (what factors contributed)

<table>
<thead>
<tr>
<th>+ factors</th>
<th>- factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>What prevented it from being worse?</td>
<td>What happened to cause the defect?</td>
</tr>
</tbody>
</table>

What can we do to reduce the risk of it happening with a different person?

<table>
<thead>
<tr>
<th>Action Plan</th>
<th>Responsible Person</th>
<th>Targeted Date</th>
<th>Evaluation Plan – How will we know risk is reduced?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

With whom shall we share our learning? (Communication plan)

<table>
<thead>
<tr>
<th>Who</th>
<th>When</th>
<th>How</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Opportunities

- Hardwire ambulation protocols
- Assure documentation of secretions
- Work collaboratively with respiratory therapy to identify subtle changes
- Daily huddle
Another Case

Mrs. X is a 76 y.o woman admitted to the ICU with septic shock requiring large volume fluid resuscitation.

She is intubated and placed on the ventilator

She is stable on the ventilator until day 4 when she has progressing oxygenation demands

She has developed a VAC
Case Evaluation

- No fever
- No increased white count
- No new antibiotics

Diagnosis: Pulmonary Edema
Opportunities for improvement?
Possible Opportunities

- Fluid Management Strategies
- CVP Monitoring
Analysis of Data

The team analyzes their data

During the first quarter they had 20 VAC’s

16 of these meet criteria for IVAC

They recognize that the usual ratio for ICU’s is 1/3 to 1/2
Opportunities

Interestingly, they find that most of the IVAC’S occur when Dr. x is the covering intensivist

This may prompt a review of antibiotic prescribing or ordering practices
Analysis

In another ICU, a large proportion of VAC’s are possible or probable pneumonia

Evaluation:
HOB monitoring?
Suctioning frequency?
SATs?
ET tubes with Subglottic suctioning?
Frequently-Asked Definition Questions

- How do I perform VAE surveillance when there are occasionally children who are cared for in my hospital’s adult ICU?
- Do I report VACs detected as a result of usual processes of care (e.g., provider weaning preferences)?
- Why do you include antimicrobials that are not used to treat respiratory infections on the list of eligible antimicrobial agents used in meeting the IVAC definition?
- How can I report Possible or Probable VAPs if my hospital lab doesn’t report Gram stain results in the way outlined in the VAE criterion for purulent respiratory secretions?
What are the goals of switching from PNEU/VAP to VAE surveillance?

- Improve reliability of definitions
- Reduce burden of surveillance
- Enhance our ability to use surveillance data to drive improvements in patient care and safety
The Bottom Line

- VAE associated with mortality and LOS (my experience supports this)
- Continue to monitor processes of care and outcomes
- Give feedback to providers and assess potential for preventable events
- Enter data into NHSN
- Notify NHSN when issues or problems are identified
Execute- Applying the NHSN Definition

INNOVATION ADOPTION LIFECYCLE

- Innovators: 2.5%
- Early Adopters: 13.5%
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%
Your Role

- Your information is important
- Feedback will pinpoint new opportunities for improvement
- Become part of the transition to a new standard of care
In a sense, this is what we do.
Conclusions

- VAE represents new approach—focus on standardized methods, objectivity, reliability
- VAE will identify broad range of events in patients on mechanical ventilation, not limited to VAP
  *Presents challenges AND opportunities
- Challenges
  *“Working out the kinks” through feedback from users and discussion with working group
- Opportunities
  *To streamline and potentially automate surveillance
  *To take a broader view of prevention and safety in mechanically-ventilated patients
References


