Infection Prevention Webinar Series:

Implementation of Strategies for the Prevention of Infection-Related Ventilator-Associated Complications (IVAC) and Possible Ventilator-Associated Pneumonia (PVAP)

August 27, 2019
Agenda

• Welcome & FHA Mission to Care HIIN Update
  – Cheryl Love, RN, BSN, BS-HCA, MBA, LHRM, CPHRM, Director of Quality and Patient Safety and Improvement Advisor, FHA

• Infection Prevention Series: IVAC and PVAP Assessment and Prevention Strategies
  – Linda R. Greene, RN, MPS, CIC, FAPIC, Manager of Infection Prevention, UR Highland Hospital, Rochester, NY

• Q&A

• Upcoming HIIN Events and Opportunities

• Evaluation Survey & Continuing Nursing Education
HIIN Core Topics – Aim is 20% reduction

- Adverse Drug Events (ADE)
- Catheter-associated Urinary Tract Infections (CAUTI)
- Clostridium Difficile Infection (CDI)
- Central line-associated Blood Stream Infections (CLABSI)
- Hospital-onset MRSA Bacteremia
- Injuries from Falls and Immobility
- Pressure Ulcers (PrU)
- Sepsis
- Surgical Site Infections (SSI)
- Venous Thromboembolisms (VTE)
- **Ventilator-Associated Events (VAE/IVAC/PVAP)**
- Readmissions (12% reduction)
- Worker Safety
Resources, Trainings and Tools

Mission to Care Website
FHA IVAC Call to Action Website
HRET HIIN Website

Infection-Related Ventilator-Associated Complications

FHA issued a Call to Action on Nov. 20, 2017, for Florida hospitals to focus their efforts on preventing ventilator-associated infections. Patients developing infection-related ventilator-associated complications (IVAC) are at high risk for outcomes such as pneumonia, peptic ulcer disease, gastrointestinal bleeding, aspiration, venous thromboembolic events and sepsis that can lead to death.

The FHA Quality Team has put together resources, education and trainings to help hospitals implement strategies to prevent IVAC.

Resources

FHA:
- IVAC Checklist: Top 10 Process Changes
- IVAC Resource Guide
- FHA UP Campaign - Cross-cutting harm reduction strategies
  - SOAP UP - Hand Hygiene
  - GET UP - Mobilize Patients
  - WAKE UP - Prevent Over-Sedation
  - SCRIPT UP - Optimize Inpatient Medications

Health Resource & Educational Trust (HRET):
- Ventilator-Associated Events (VAE) Change Package
- VAE 2017 Checklist/Date of Last VAE Poster
- VAE Resource Library
- Case Study
- Journal Articles
  - High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure

Hospital Acquired Infections (HAIs)

Ventilator-Associated Event (VAE)

Ventilator-associated events are lung infections, such as pneumonia, and other complications occurring in patients who are on mechanical ventilation breathing apparatuses.

Goal: By September 27, 2018, a 20 percent reduction in VAE

Resources to prevent VAE:

- VAE Change Package
- VAE Checklist
- Infection-Related Ventilator-Associated Complications (IVAC) Resource Guide
- IVAC Checklist: Top 10 Process Changes
- Watch Past Virtual Trainings
- HRET HIIN Resource Library
- Success Stories
- SOAP UP
- GET UP
- WAKE UP
Designed to reduce multiple forms of harm with simple, easy-to-accomplish activities that cut across several topics to decrease harm.

Focused on four components:

- **SOAP UP**: Hardwire Hand Hygiene
- **GET UP**: Mobilize Patients
- **WAKE UP**: Prevent Over-sedation
- **SCRIPT UP**: Optimize Inpatient Medications
FHA Mission to Care Update:
Ventilator-associated Condition Rate

Source: HRET Comprehensive Data System, August 26, 2019

<table>
<thead>
<tr>
<th>FL Rate</th>
<th>HRET HIIN Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL 6.58</td>
<td>4.92</td>
</tr>
<tr>
<td>O-16 5.21</td>
<td>4.81</td>
</tr>
<tr>
<td>N-16 6.29</td>
<td>4.59</td>
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<tr>
<td>D-16 4.99</td>
<td>4.92</td>
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<tr>
<td>J-17 5.41</td>
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<tr>
<td>F-17 5.52</td>
<td>4.85</td>
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<tr>
<td>M-17 5.37</td>
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<td>A-17 6.29</td>
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<tr>
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<td>5.27</td>
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<tr>
<td>O-17 6.11</td>
<td>4.97</td>
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<td>N-17 5.05</td>
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<td>F-18 7.12</td>
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<td>M-17 5.43</td>
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<tr>
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<td>N-17 5.25</td>
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<td>D-17 5.36</td>
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<td>J-18 5.02</td>
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<td>4.91</td>
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<td>M-18 5.26</td>
<td>5.21</td>
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<td>F-18 5.34</td>
<td>5.02</td>
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<td>M-17 5.87</td>
<td>5.34</td>
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<tr>
<td>A-17 5.21</td>
<td>5.26</td>
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<tr>
<td>S-17 5.24</td>
<td>5.26</td>
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<tr>
<td>O-17 5.31</td>
<td>5.34</td>
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<tr>
<td>N-17 5.19</td>
<td>5.26</td>
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<tr>
<td>D-17 5.05</td>
<td>5.34</td>
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# FL Reporting | 76  74  74  75  76  76  75  76  76  76  76  76  76  76  76  76  77  76  75  73  73  72  68  68  68  72  68  69  69  69  69  73  73  72  72  72  70  69  63
# HRET HIIN Reporting | 913 911 904 896 898 891 891 883 881 879 881 877 876 882 875 873 868 861 858 853 861 855 852 850 849 845 847 842 830 818 818 808 800 735

Source: HRET Comprehensive Data System, August 26, 2019
FHA Mission to Care Update:
Infection-related Ventilator-associated Condition Rate

Source: HRET Comprehensive Data System, August 26, 2019
FHA Mission to Care Update: Possible Ventilator Association Pneumonia (PVAP)

Source: HRET Comprehensive Data System, August 26, 2019

Rate per 1,000

FL Rate 0.76 0.57 0.11 0.24 0.84 0.62 0.24 0.95 0.92 0.68 0.47 1.26 0.32 0.99 0.55 0.94 0.45 0.95 1.54 0.47 1.21 0.68 1.19 0.65 0.86 0.70 1.64 0.76 0.50 0.40 0.90

HRET HIIN Rate 0.54 0.56 0.49 0.38 0.50 0.62 0.55 0.41 0.61 0.60 0.59 0.66 0.73 0.82 0.47 0.48 0.66 0.62 0.45 0.44 0.58 0.74 0.90 0.73 0.70 0.58 0.56 0.61 0.80 0.49 0.59 0.49 0.64 0.60

# FL Reporting 55 50 50 51 53 53 53 50 50 52 51 52 52 53 55 54 52 55 56 56 56 55 56 56 57 57 58 58 57 58 58 58 54

#HRET HIIN Reporting 608 682 684 676 696 693 692 688 691 691 695 698 703 709 704 708 706 703 707 709 713 714 715 722 719 710 707 703 709 700 694 661

Source: HRET Comprehensive Data System, August 26, 2019
## FHA Mission to Care Update: Florida | Ventilator-associated Events

### Summary of Progress Meeting 20/12 Goal:

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<thead>
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<th>PTD</th>
<th>Reduction</th>
<th>Most Recent</th>
<th>Reduction</th>
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<td>0</td>
<td>20% or greater (12% readmissions)</td>
<td>1: 33.3%</td>
<td>20% or greater (12% readmissions)</td>
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<tr>
<td>1</td>
<td>15% - 19% (9% - 11% readmissions)</td>
<td>0: 0.0%</td>
<td>15% - 19% (9% - 11% readmissions)</td>
</tr>
<tr>
<td>1</td>
<td>0% - 14% (0% - 8% readmissions)</td>
<td>1: 33.3%</td>
<td>0% - 14% (0% - 8% readmissions)</td>
</tr>
<tr>
<td>3</td>
<td>Increase instead of reduction</td>
<td>1: 33.3%</td>
<td>Increase instead of reduction</td>
</tr>
</tbody>
</table>

### Measure Rates per 1,000

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline</th>
<th># Harms</th>
<th>Denom.</th>
<th>Average Rate</th>
<th>Progress</th>
<th>March 2019 - May 2019</th>
<th>Hospital Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator-associated condition rate</td>
<td>6.58</td>
<td>2,657</td>
<td>471,366</td>
<td>5.64</td>
<td>-14.3%</td>
<td>36,706</td>
<td>6.35 -3.5%</td>
</tr>
<tr>
<td>Infection-related ventilator-associated condition rate</td>
<td>2.20</td>
<td>873</td>
<td>466,786</td>
<td>1.87</td>
<td>-15.0%</td>
<td>36,684</td>
<td>2.21 0.4%</td>
</tr>
<tr>
<td>Possible ventilator associated pneumonia</td>
<td>0.76</td>
<td>244</td>
<td>318,735</td>
<td>0.77</td>
<td>0.7%</td>
<td>28,782</td>
<td>0.59 -22.3%</td>
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</tbody>
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## Infection Prevention Virtual Series

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Register Online</th>
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</thead>
<tbody>
<tr>
<td>Oct. 23, 2018</td>
<td>NHSN: SSI Surveillance Identification and Analysis</td>
<td>Event archive*</td>
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<tr>
<td>Nov. 20, 2018</td>
<td>SSI-Colon: How to Assess Root Cause and Prevention Strategies</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Dec. 18, 2018</td>
<td>NHSN: VAE Surveillance Identification and Analysis</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Jan. 22, 2019</td>
<td>VAE: How to Assess Root Cause and Prevention Strategies</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Feb. 19, 2019</td>
<td>NHSN: MRSA Bacteremia Surveillance Identification and Analysis</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Mar. 26, 2019</td>
<td>MRSA Bacteremia: How to Assess Root Cause and Prevention Strategies</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Jul. 24, 2019</td>
<td>Implementation of Best Practices for VAE Prevention</td>
<td>Event archive*</td>
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</tbody>
</table>


*Access Event Archives ([Recordings | Slides](#)) on the Mission to Care HIIN Website*
## Surgical Infection Prevention (SIP) Webinar Series

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Register Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. 26, 2019</td>
<td>SIP Webinar Series #1: Pre-operative Strategies for Prevention of SSI</td>
<td>Event archive*</td>
</tr>
<tr>
<td>May 22, 2019</td>
<td>SIP Webinar Series #2: Intra-operative Strategies for Prevention of SSI</td>
<td>Event archive*</td>
</tr>
<tr>
<td>Jun. 25, 2019</td>
<td>SIP Webinar Series #3: Post-operative Strategies for Prevention of SSI</td>
<td>Event archive will be posted online</td>
</tr>
</tbody>
</table>

**Preventing Post-Surgical Harm Resource Guide** (Jun. 5, 2019)

*Access Event Archives (Recordings | Slides) on the Mission to Care HIIN Website*
IVAC and PVAP
Assessment and Prevention Strategies

Linda R. Greene, RN, MPS, CIC, FAPIC
Linda_Greene@urmc.rochester.edu
Objectives

- Review IVAC and P VAP definition
- Discuss Current Literature related to IVAC and PVAP
- Describe key prevention strategies to prevent VAE
Polling Question

What is your background?

1. Infection Prevention
2. Respiratory Care
3. Quality
4. Nursing
5. Other
Background

- Over the past decade, hospital-based quality improvement initiatives focused on the prevention of device-related infections, resulting in significant decreases in reported cases of HAIs.

- Among device-related HAIs, ventilator associated pneumonia (VAP) is of prime concern as ventilated patients are at higher risk for acquiring pneumonia than non-ventilated patients.

Background

• Definition changed in 2013

• Challenges with inter-rater reliability related to CXR

• No major changes except:
  Possible and Probable VAP- Now PVAP
  Pathogen updates
Study

A retrospective cohort study examining 20,356 episodes of mechanical ventilation (MV)\(^1\)

- VAEs
  - 1,141 ventilator-associated conditions (VACs)
  - 431 infection-related VACs (IVACs)
  - 266 possible cases of ventilator-associated pneumonia (PVAP)

- Patients with a VAE have—
  - More days to extubation
  - More days to discharge
  - Higher mortality rate

Let's Review

VAE 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 VAP (PVAP)

No CXR needed!
What are the Challenges?

Capturing Data:

Surveillance challenges

- Manual Surveillance
  - 40% Sensitivity, 98% specificity, PPV 70%
- Automated
  - 71% Sensitivity 98% specificity, PPV 100%

Conclusion: Manual surveillance is prone to human error

Sheony et.al *ICHE* July 2018, 39; 7
Other Issues

Ventilator-associated pneumonia (VAP) is one of the most frequent hospital-acquired infections occurring in intubated patients.

Because VAP is associated with higher mortality, morbidity, and costs, there is a need to solicit further research for effective preventive measures. VAP has been proposed as an indicator of quality of care.

Clinical diagnosis has been criticized to have poor accuracy and reliability.

Thus, the Centers for Disease Control and Prevention VAE definition based upon objective and recordable data.

Some institutions reporting a VAP zero rate in surveillance programs, which is in discrepancy with clinical data.

Mietto C., Respir Care 2013;58(6):990-1007.
Challenges Continued

Ongoing uncertainty about VAE and concern about its limited overlap with clinically-defined VAP

Possible VAPs missed by VAE surveillance are associated with lower mortality rates than VAEs and have similar outcomes whether treated with ≤3 days of antibiotics or more conventional courses, suggesting VAE focuses surveillance on severe events.

Klompas https://doi.org/10.1016/j.cmi.2019.03.027
Polling Question

Is your surveillance for VAE:

1. Manual
2. Automated or semi automated
3. Don’t know
<table>
<thead>
<tr>
<th>PVAP (CDC 2013 definition)</th>
<th>VAP (CDC 2008 definition)</th>
<th>VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical criteria</strong></td>
<td>One of the following:</td>
<td>Suspension of infection&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>1. Worsening gas Exchange&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Tachypnea or dyspnea</td>
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</tr>
<tr>
<td></td>
<td>3. Change in sputum characteristics&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
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<td></td>
<td>4. Rales or bronchial breath sounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>And at least one:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Suspicion of infection&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Altered mental status in adults</td>
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<tr>
<td></td>
<td>≥ 70 years old&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
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<tr>
<td><strong>Radiological criteria</strong></td>
<td>New or progressive infiltrate, consolidation or cavitation</td>
<td></td>
</tr>
<tr>
<td>Not included</td>
<td>Absence of radiologic criteria for pneumonia</td>
<td></td>
</tr>
<tr>
<td><strong>Microbiological criteria</strong></td>
<td>1. Significant growth of a pathogen in respiratory samples&lt;sup&gt;g&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Insufficient growth of a pathogenic microorganism plus purulent sputum&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Pathogenic microorganism in pleural fluid cultures</td>
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<tr>
<td></td>
<td>4. Histopathologic evidence of lung infection&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Positive test for pathogenic virus in respiratory samples</td>
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<tr>
<td></td>
<td>6. Positive test for Legionella species</td>
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</tr>
<tr>
<td></td>
<td>Positive endotracheal aspirate culture And</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purulent sputum&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**PVAP** possible ventilator associated pneumonia, **VAP** ventilator associated pneumonia, **VAT** ventilator associated tracheobronchitis

<sup>a</sup> Worsening gas exchange: increased oxygen requirements or in ventilator demand

<sup>b</sup> Change in sputum characteristics: new onset of purulent respiratory secretions or increase in its production or in suctioning requirements

<sup>c</sup> Suspicion of infection: leukocytosis (≥ 12,000 cells/mL) or leukopenia (≤ 4000 cells/mL) or fever (≥ 38 °C) or hypothermia (≤ 36 °C)

<sup>d</sup> Significant growth in respiratory samples: endotracheal aspirate: ≥ 10<sup>3</sup> CFU/mL, bronchoalveolar lavage: ≥ 10<sup>4</sup> CFU/mL, lung tissue: ≥ 10<sup>4</sup> CFU/g, protected specimen brush: ≥ 10<sup>3</sup> CFU/mL

<sup>e</sup> Histopathologic evidence of lung infection: abscess formation or foci of consolidation with intense polymorphonuclear accumulation or positive quantitative culture of parenchyma or evidence of parenchyma invasion by fungus or virus

<sup>f</sup> Purulent sputum: >25 neutrophils and ≤ 10 squamous epithelial cells per low power field

<sup>g</sup> Without other recognized focus
What is an IVAC

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature $> 38^\circ$C or $< 36^\circ$C, OR white blood cell count $\geq 12,000$ cells/mm$^3$ or $\leq 4,000$ cells/mm$^3$.

AND

2) A new antimicrobial agent(s)* is started, and is continued for $\geq 4$ calendar days.

*See Appendix for eligible agents.
Important Points IVAC

- An IVAC means that the patient who met VAC criteria also developed an infection.

- This is not necessarily a respiratory infection.

- However, the algorithm requires us to now check for a PVAP.
Infection/Inflammation Component

- Eligible Temperature or WBC Count
- \( \geq 4 \) Qualifying Antimicrobial Days
- VAC

IVAC
## 2019 NHSN Ventilator-Associated Event (VAE) Checklist

### Ventilator-Associated Event (VAE) Summary

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Criterion Met</th>
<th>Date of Event (DOE)</th>
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</thead>
<tbody>
<tr>
<td>VAC</td>
<td>✗</td>
<td>8/10</td>
</tr>
<tr>
<td>IVAC</td>
<td>✗</td>
<td>8/11</td>
</tr>
<tr>
<td>PVAP</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>

Please refer to [Chapter 10 Ventilator-Associated Event (VAE)](#) of the Patient Safety Manual for additional information.

### Ventilator Associated Event (VAE)

#### Ventilator Associated Condition (VAC)

<table>
<thead>
<tr>
<th>Element</th>
<th>Element Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient has at least one of the following:</td>
<td></td>
</tr>
<tr>
<td>- Baseline period of stability* on the ventilator</td>
<td>✗</td>
</tr>
<tr>
<td>- Baseline period of improvement* on the ventilator</td>
<td>[ ]</td>
</tr>
<tr>
<td>AND After a period of stability or improvement (as above), patient has at least one of the following indicators of worsening oxygenation:</td>
<td></td>
</tr>
<tr>
<td>1. Increase in daily minimum** FiO₂ of ≥ 0.20 (20 points) over daily minimum FiO₂ of the first day in the baseline period, sustained for ≥ 2 calendar days</td>
<td>[ ]</td>
</tr>
<tr>
<td>2. Increase in daily minimum** PEEP values of ≥ 3 cm H₂O** over daily minimum PEEP of the first day in the baseline period, sustained for ≥ 2 calendar days</td>
<td>✗</td>
</tr>
</tbody>
</table>
Patient must meet VAC to be eligible for IVAC

On or after calendar day 3 of mechanical ventilation (MV) and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following:

Patient has one of the following:
- Temperature >38°C (>100.4°F)
- Temperature <36°C <96.8°F
- White blood cell count ≥ 12,000 cells/mm³
- White blood cell count ≤ 4,000 cells/mm³

AND Patient meets all of the following:
- A new antimicrobial agent(s)* is started
- The new antimicrobial agent(s)** is continued for ≥ 4 qualifying antimicrobial days (QAD)

---

### Possible Ventilator-Associated Pneumonia (PVAP)

Patient must meet VAC and an IVAC to be eligible for PVAP

AND Patient must meet one of the following criteria on or after calendar day 3 of MV and within 2 calendar days before or after the onset of worsening oxygenation (Refer to Chapter 10 for organisms excluded from meeting PVAP):

1. **Criterion 1:** Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, ≥10⁵ CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, ≥10⁴ CFU/ml or corresponding semi-quantitative result
   - Lung tissue, ≥10⁴ CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, ≥10³ CFU/ml or corresponding semi-quantitative result

2. **Criterion 2:** Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100]) PLUS organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):
Analysis

Stopped at the IVAC

Infectious process associated with worsening values on the vent

What Next?
Microbiology and Vitals

- Urinary catheter in place for 7 days on culture date (Within 3 day window) – Grew 100,000 Ecoli
- Temp spike to 38.5 on day of culture

What do we have?
Answer

- Both an IVAC and a CAUTI
- Patients on a vent are likely to be prone to other infections as well
Let’s change the scenario

Scenario – Surgical ICU has large number of IVACs

Possible Actions and Analysis:

High antibiotic utilization could shift a high number of their VACs to IVACs

Case review- what is triggering the event

Are these real infections? If not, why were vent settings and antibiotics changed?
Associated Strategies

- CHG bathing
- Urinary catheter and central line usage
- Central line care and maintenance
<table>
<thead>
<tr>
<th>Element</th>
<th>Element Met</th>
</tr>
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<tbody>
<tr>
<td>Patient must meet VAC and an IVAC to be eligible for PVAP</td>
<td></td>
</tr>
<tr>
<td><strong>AND</strong> Patient must meet one of following criteria on or after calendar day 3 of MV and within 2 calendar days before or after the onset of worsening oxygenation (Refer to Chapter 10 for organisms excluded from meeting PVAP):</td>
<td></td>
</tr>
<tr>
<td>1. <strong>Criterion 1</strong>: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:</td>
<td></td>
</tr>
<tr>
<td>• Endotracheal aspirate, $\geq 10^5$ CFU/ml or corresponding semi-quantitative result</td>
<td>X</td>
</tr>
<tr>
<td>• Bronchoalveolar lavage, $\geq 10^4$ CFU/ml or corresponding semi-quantitative result</td>
<td></td>
</tr>
<tr>
<td>• Lung tissue, $\geq 10^4$ CFU/g or corresponding semi-quantitative result</td>
<td></td>
</tr>
<tr>
<td>• Protected specimen brush, $\geq 10^5$ CFU/ml or corresponding semi-quantitative result</td>
<td></td>
</tr>
<tr>
<td>2. <strong>Criterion 2</strong>: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain $\geq 25$ neutrophils and $\leq 10$ squamous epithelial cells per low power field [lpf, x100]) PLUS organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):</td>
<td></td>
</tr>
<tr>
<td>• Sputum</td>
<td></td>
</tr>
<tr>
<td>• Endotracheal aspirate</td>
<td></td>
</tr>
<tr>
<td>• Bronchoalveolar lavage</td>
<td></td>
</tr>
<tr>
<td>• Lung tissue</td>
<td></td>
</tr>
<tr>
<td>• Protected specimen brush</td>
<td></td>
</tr>
<tr>
<td>3. <strong>Criterion 3</strong>: One of the following positive tests:</td>
<td></td>
</tr>
<tr>
<td>• Organism identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)</td>
<td></td>
</tr>
<tr>
<td>• Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens</td>
<td></td>
</tr>
</tbody>
</table>
Goal

Get the patient off the ventilator sooner
Assess readiness to extubate daily in patients without contraindications

Paired spontaneous breathing trials with spontaneous awakening trials
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Rationale</th>
<th>Intervention</th>
<th>Quality of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic practices</td>
<td>Good evidence that the intervention decreases the average duration of mechanical ventilation, length of stay, mortality, and/or costs; benefits likely outweigh risks</td>
<td>Use noninvasive positive pressure ventilation in selected populations(^{57,58}) Manage patients without sedation whenever possible(^{56,61}) Interrupt sedation daily(^{52}) Assess readiness to extubate daily(^{47,66-68}) Perform spontaneous breathing trials with sedatives turned off(^{48}) Facilitate early mobility(^{49,70-75,78}) Utilize endotracheal tubes with subglottic secretion drainage ports for patients expected to require greater than 48 or 72 hours of mechanical ventilation(^{50}) Change the ventilator circuit only if visibly soiled or malfunctioning(^{88-91}) Elevate the head of the bed to 30°–45°(^{88-89})</td>
<td>High</td>
</tr>
<tr>
<td>Special approaches</td>
<td>Good evidence that the intervention improves outcomes but insufficient data available on possible risks</td>
<td>Selective oral or digestive decontamination(^{95-96})</td>
<td>High(^b)</td>
</tr>
<tr>
<td></td>
<td>May lower VAP rates but insufficient data to determine impact on duration of mechanical ventilation, length of stay, or mortality</td>
<td>Regular oral care with chlorhexidine(^{88,101-104}) Prophylactic probiotics(^{111-114}) Ultrathin polyurethane endotracheal tube cuffs(^{120,121}) Automated control of endotracheal tube cuff pressure(^{142,125}) Saline instillation before tracheal suctioning(^{124}) Mechanical tooth brushing(^{125,126})</td>
<td>Moderate</td>
</tr>
<tr>
<td>Generally not</td>
<td>Lowers VAP rates but ample data suggest no impact on duration of mechanical ventilation, length of stay,</td>
<td>Silver-coated endotracheal tubes(^{127}) Kinetic beds(^{128}) Prone positioning(^{87,129-134,c})</td>
<td>Moderate</td>
</tr>
<tr>
<td>recommended</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Prevention Strategies

- Avoid intubation if possible
- Minimize sedation

Assess readiness to extubate once a day (spontaneous breathing trials)

Interrupt sedation once a day (spontaneous awakening trials)

Pair spontaneous breathing trials with spontaneous awakening trials

Patients are more likely to pass a spontaneous breathing trial and get extubated if they are maximally awake at the time of the breathing trial
Other Strategies

Minimize pooling of secretions above the endotracheal tube cuff

- Provide endotracheal tubes with subglottic secretion drainage ports for patients likely to require more than 48 or 72 hours of intubation

(Extubating patients in order to place a subglottic secretion drainage endotracheal tube is not recommended)
Bundle Compliance and Death

Retrospective analysis of 5,539 patients on mechanical ventilation
adjusted for comorbidities, severity of illness, contraindications, etc.

Hazard Ratios for Ventilator Death

Spontaneous breathing trials
Spontaneous awakening trials
Head of bed elevation
Thromboprophylaxis
Stress ulcer prophylaxis
Oral care with chlorhexidine
Head of Bed

Elevate the head of the bed to 30-45°

- A trial in 86 patients showed that semi recumbent positioning reduced the rates of clinically suspected and microbiologically proven nosocomial pneumonia by 4-fold.

- A Cochrane literature review based on small and potentially biased studies found an overall benefit in reducing VAP rates when patients were positioned at 30° to 60°.
What about Mouth Care?

Tooth brushing for critically ill mechanically ventilated patients: a systematic review and meta-analysis of randomized trials evaluating ventilator-associated pneumonia.

Six trials enrolling 1,408 patients, five of which compared tooth brushing to usual oral care and one of which compared electric with manual tooth brushing.

Four trials, there was a trend toward lower ventilator-associated pneumonia rates (risk ratio, 0.77; 95% confidence interval, 0.50-1.21; p = 0.26).

No impact on length of stay, morbidity or mortality

What About Oral Care With Chlorhexidine?

- Routine oral care with chlorhexidine
- Prevents nosocomial pneumonia in cardiac surgery patients
  - May not decrease VAP risk in noncardiac surgery patients
- Does not affect—
  - Mortality
  - Duration of MV
  - Intensive care unit (ICU) LOS

What about Feeding?

Not addressed in previous compendium

Early vs. Late

Gastric vs. small bowel

TPN vs. Tube feeding
Small bowel feeding and risk of pneumonia in adult critically ill patients: a systematic review and meta-analysis of randomized trials

Systematic review and meta-analysis aimed to evaluate the effect of small bowel feeding compared with gastric feeding on the frequency of pneumonia and other patient-important outcomes in critically ill patients.

19 trials - 1,394 patients

SBO vs. Gastric feeding decreased risk of pneumonia and VAP risk ratio [RR] 0.70; 95% CI, 0.55, 0.90; P = 0.004

* Did not affect mortality, ICU Stay or duration of ventilation

Alhazzani et al. Critical Care 2013, 17:R127
Feedings

Cochrane review June 2018 Enteral vs. SB

- 2018 23 RCT’s and 2 quasi randomized
- No difference in VAP, LOS or Mortality
Patient Population

Large prospective data base of patients admitted with shock

Enteral Feeding associated with a higher risk of VAP

What about bundles?

Two-State Collaborative Study of a Multifaceted Intervention to Decrease Ventilator-Associated Events

Setting: Fifty-six ICUs at 38 hospitals in Maryland and Pennsylvania from October 2012 to March 2015.

Evidence-based interventions promoted by the collaborative included head-of-bed elevation, use of subglottic secretion drainage endotracheal tubes, oral care, chlorhexidine mouth care, and daily spontaneous awakening and breathing trials.

Measurements and Results: ICUs reported 69,417 ventilated patient-days of intervention compliance observations and 1,022 unit-months of ventilator-associated event data.

The quarterly mean ventilator-associated event rate significantly decreased from 7.34 to 4.58 cases per 1,000 ventilator-days after 24 months of implementation (p = 0.007).

During the same time period, infection-related ventilator-associated complication and possible and probable ventilator-associated pneumonia rates decreased from 3.15 to 1.56 and 1.41 to 0.31 cases per 1,000 ventilator-days (p = 0.018, p = 0.012), respectively.

Rawat et.al Critical Care Medicine : Volume 45(7), July 2017, p 1208-1215
Does educating nurses with ventilator-associated pneumonia prevention guidelines improve their compliance?

- **Background:** This study aimed to compare the compliance with ventilator-associated pneumonia (VAP) prevention guidelines between nurses who underwent an intensive educational program and those who did not, and to investigate other factors that influence nurses’ compliance.

- **Method:** A 2-group posttest design was used to examine the effect of the VAP-prevention guidelines education on nurses’ compliance. Participants were randomly assigned to experimental and control groups.

- **Results:** The overall nurses’ compliance scores were moderate. There was no statistically significant difference in compliance between the nurses who received VAP education and those who did not ($P = .15$). The number of beds in the unit and the nurse–patient ratio were found to influence nurses’ compliance.

- **Conclusion:** Education in VAP-prevention guidelines will not improve nurses’ compliance unless other confounding factors, such as their workload, are controlled. It is imperative to reduce nurses’ workload to improve their compliance and enhance the effectiveness of education.
Ventilator associated pneumonia

**Care bundles**
- Limit use of mechanical ventilation
- Prevent aspiration of secretions
- Prevent nasal and oropharyngeal colonisation
- Prevent use of contaminated equipment
- Early mobilisation

**Standard of care**
- Series of fundamental, interdependent and scientifically grounded nursing steps grouped into bundles aimed to control microorganisms in the oropharynx for which the CTICU RN has sole responsibility

**Nursing sensitive patient outcome**
- VAP acquisition rate

**Nursing sensitive indicators**
- Specific nursing assessment indicators such as daily assessment of readiness to wean and nursing intervention indicators such as the use of cuffed ETT with above cuff aspirate
- 70% benchmark set to validate nursing compliance and performance
- Quarterly surveillance/reporting of the indicators of each VAP prevention bundle with consideration of broader infection control dashboard indicators
Conclusions

- Recent studies support that patients with PVAP have higher mortality than those with clinically defined pneumonia.

- We may need to better understand the impact of PVAP on mortality, duration of mechanical ventilation and LOS.

- Evidence is most robust for daily spontaneous awakening trials, daily spontaneous breathing trials, coordination of spontaneous awakening and breathing trials, and conservative fluid management.

- Current practices such as HOB elevation, oral care and physical conditioning can impact P VAP rates.
Questions?
Upcoming Virtual Events

Aug. 27 (Webinar)
FDOH | Methicillin-resistant Staphylococcus aureus Prevention

Sep. 4 (Webinar)
FHA | Monthly Quality Hot Topics Virtual Meeting #10

Sep. 10 (Webinar)
FHA/FDOH | Developing an eReferral Tobacco Free Florida Program

Check the weekly MTC HIIN Upcoming Events for details and registration
Upcoming HIIN Regional Forums

Focus on Implementation and Improvement...

In-Person Meetings

HIGHLIGHTS:

• Support and resources for targeted harm topics
• Inter-facility discussion highlighting approaches and solutions that have been successful in moving the needle toward ZERO HARM
• Peer-learning forum for discussing successes and challenges, along with implementation and sustainability practices

Suggested Audience:
All HIIN project leads and clinical leaders are encouraged to attend, specifically key team members who are engaged in direct patient care and can bring evidence-based practice to the bedside.

Dates / Locations / Topics:

Sep. 24 - North FL | Sepsis, VAE
Baptist Medical Center South, Jacksonville

Sep. 30 - Southeast FL | Falls, Sepsis, SSI
Memorial Regional Hospital, Hollywood

Oct. 3 - Central FL | Falls, Sepsis
FHA Corporate Office, Orlando

Oct. 10 - Panhandle | Falls, HAPI, Sepsis
Sacred Heart Hospital, Pensacola

Nov. 6 - Southwest FL | Falls, Sepsis
Gulf Coast Medical Center, Ft. Myers

Register to attend one or more: http://www.cvent.com/d/5yqvv9
Register today at www.FHAAnnualMeeting.com
Early Bird – Register by Aug. 31
Eligibility for Nursing CEU requires submission of an evaluation survey for each participant requesting continuing education: [https://www.surveymonkey.com/r/IP08272019](https://www.surveymonkey.com/r/IP08272019)

- Share this link with all of your participants if viewing today’s webinar as a group (Survey closes Sep. 7, 2019)
- Be sure to include your contact information and Florida nursing license number
- FHA will report 1.0 credit hour to CE Broker and a certificate will be sent via e-mail (Please allow at least 2 weeks after the survey closes)
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