The Effects of Bundle Adherence on Ventilator-Associated Pneumonia: A Quality Improvement Project

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The Effects of Bundle Adherence on Ventilator-Associated Pneumonia

SARA BORGES, MA RN
Problem Identification

5-40% of ventilated patients develop pneumonia (VAP)

Increases time spent on a ventilator, days in Critical Care, and costs

Increases mortality risk by 10-40%

(Collard et al., 2003)
**VENTILATOR ASSOCIATED EVENTS (VAE)**

**VAC**
- Period of stable or decreasing FiO2 or PEEP for > 2 days
  - Worsening oxygenation (FiO2 > 0.20 OR PEEP > 3 increase for > 2)

**IVAC**
- **VAC criteria**
  - Evidence of infection (abnormal temp or WBC)
  - **AND** new antibiotics started

**PVAP**
- **IVAC criteria**
  - Positive culture results or purulent sputum

(AHRQ, 2017)
### VAP Prevention Bundle

- **Every 2 hours:** Oral care, HOB elevated 30-45 degrees
- **Every 12 hours:** Brush teeth, CHG mouth, deep suction, sedation vacation
- **Every 24 hours:** Spontaneous breathing trial and DVT and PUD prophylaxis (medications)
- **Hi-Lo Evac tubes connected to continuous suction**
PICOT Question

"In mechanically ventilated adults (P), how does adherence to a ventilator-associated pneumonia (VAP) bundle (I) compared to no bundle adherence (C) affect VAP rates (O) during hospitalization (T)?"
Project Purpose

• Provide training to increase awareness of VAP bundle components
AIMS OF PROJECT

- Increase bundle adherence to 100%
- Decrease VAP rates by 10%
Levin's EBPI Model Framework

- Describe the problem
- Formulate focused clinical question
- Search the evidence
- Appraise & synthesize evidence
- Develop aim/goal statement
- PDSA cycles
- Disseminate best practices

(Levin et al, 2010)
Literature Search

(From Moher et al., 2009)
Critical Appraisal

- John Hopkins Nursing Evidence-Based Practice (JHNEBP) research evidence appraisal tool

- JHNEBP Evidence Level and Quality Guide
<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Bundle Adherence</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>VAP rates</td>
<td>+ *</td>
<td>NE</td>
<td>* ↓</td>
<td>+ +</td>
<td>+</td>
<td>* ↓</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Sample</td>
<td>VAP cases/1000</td>
<td>47 Studies</td>
<td>52,946 ventilator days</td>
<td>273 patients with VAE diagnosis</td>
<td>3845 ventilator days</td>
<td>433 ventilated patients</td>
<td>87,537 ventilator days</td>
<td>46 interviews and 1576 bundle component observations</td>
</tr>
<tr>
<td>Level of Evidence</td>
<td>Level III</td>
<td>Level III</td>
<td>Level III</td>
<td>Level III</td>
<td>Level III</td>
<td>Level III</td>
<td>Level II</td>
<td>Level III</td>
</tr>
<tr>
<td>Quality of Evidence</td>
<td>B (Good)</td>
<td>B (Good)</td>
<td>B (Good)</td>
<td>B (Good)</td>
<td>B (Good)</td>
<td>B (Good)</td>
<td>A (High)</td>
<td>B (Good)</td>
</tr>
<tr>
<td>Information related to PICOT</td>
<td>There is correlation between VAP bundle compliance and reduction in VAP incidence</td>
<td>The most frequently used strategies for bundle compliance were education, reminders and audit and feedback</td>
<td>Implementing an electronic dashboard provided reminders for bundle elements not in compliance</td>
<td>No association between increased bundle compliance and reduced risk of VAE</td>
<td>Efforts should be concentrated in continuous education of multidisciplinary providers to maintain high levels of compliance</td>
<td>An educational intervention increased adherence to the bundle, but incidence of VAP did not decrease</td>
<td>A real-time bundle adherence dashboard was associated with significant decreases in VAP rates and an increase in bundle compliance</td>
<td>Technical, rather than education-based, solutions should be promoted to improve VAP prevention</td>
</tr>
</tbody>
</table>

Note. → No Association; ↑ Increased; ↓ Decreased; NE = Not Evaluated; * Statistical Significance; + Clinical Significance
Recommendations for Practice

- Good and Consistent Evidence
- Educate multi-disciplinary providers
- Implement adherence dashboard
Project Team

- DNP Student
- Project Chair
- CCU Manager
- UTK Statistician
Ethical Considerations
PDSA Cycles
Education

Skills Day
Staff Meetings
GroupMe/Reminders
Physician Meetings
Tele-ICU

“TEAM WEAN” Ventilator Management

**SAT SAFETY SCREEN**
- No Active Seizures
- No Acute Gastrointestinal bleed
- No Malignant Neoplasms
- No multiple organ system failures
- No Surgical Patient with Open Abdomen

**PERFORM SAT (SPO2 & NONINVASIVE PEEP)**
- Sphere: Saturations
- Non-invasive PEEP
- ABG
- FEV1
- Expiratory Flow
- Oxygen Saturation
- Heart Rate
- BP

**SBT SAFETY SCREEN**
- No Active Seizures
- No Acute Gastrointestinal bleed
- No Malignant Neoplasms
- No multiple organ system failures
- No Surgical Patient with Open Abdomen

**PERFORM SBT (SPONTANEOUS BREATHING TRIAL)**
- Sphere: Saturations
- Non-invasive PEEP
- ABG
- FEV1
- Expiratory Flow
- Oxygen Saturation
- Heart Rate
- BP

**READY TO EXTRABATE? CALL LOCAL MD OR TELE-ICU**

**NATIONAL BEST PRACTICE**
- Get H&@ & ABG
- Get Prophylaxis (Stress Ulcer Prevention)
- Get Prophylaxis (Protein Calorie Nutrition)
- Get Prophylaxis (Vascular Access)
- Get Prophylaxis (Pneumonia Prevention)

**CALL LOCAL MD OR TELE-ICU**

**DIFFICULT TO WEAN?**
- Bronchospasm
- Heart Disease / Cardiac Failure
- Endocrine / Metabolic Issues
- Anemia / Hematologic
- Neurologic / Nervous System Disease
- Sepsis
- Nutritional Malnutrition
- Excessive Fatigue / Lethargy
- Thyroid Disease
- Nitric Oxide Leaks
- Need Sustained VP / HAP / HME Extrication

**EVERY 24 HOURS**

**CALL LOCAL MD OR TELE-ICU**

**IMPORTANT:** If calling Tele-ICU for an extubation order, obtain an ABG after 30 minutes on PSV. (P EEP & P PS)

Please call Tele-ICU **&** if you need the above extubation orders.
Findings
Data Security

- Unique Patient ID
- Password Protected Excel
- OneDrive Account
- UTK’s Vault
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pre-Implementation (n=20)</th>
<th>Post-Implementation (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (M ± SD) in years</strong></td>
<td>66.5 ± 8.10</td>
<td>70.3 ± 13.62</td>
</tr>
<tr>
<td><strong>Sex (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>53%</td>
<td>47%</td>
</tr>
<tr>
<td>Male</td>
<td>47%</td>
<td>53%</td>
</tr>
<tr>
<td><strong>Admit Diagnosis</strong></td>
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<td></td>
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<tr>
<td>Resp Failure</td>
<td>49.40%</td>
<td>73%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>41.50%</td>
<td>15.80%</td>
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<tr>
<td>Hypoxia</td>
<td>7.10%</td>
<td>1.70%</td>
</tr>
<tr>
<td>Other</td>
<td>1.90%</td>
<td>9.50%</td>
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<tr>
<td><strong>Covid + (on admission)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>63.2</td>
<td>17.2</td>
</tr>
<tr>
<td>No</td>
<td>32.8</td>
<td>82.8</td>
</tr>
</tbody>
</table>
Head of Bed Compliance by Year

COMPLIANT - NON-CORE
- 2021: 68%
- 2020: 67%
- \( p = 0.805 \)

COMPLIANT - CORE
- 2021: 97%
- 2020: 84%
- \( p < .001 \)
Spontaneous Breathing Trial Compliance by Year

- **COMPLIANT - NON-CORE**
  - 2021: 51%
  - 2020: 5%
  - $p = 0.002$

- **COMPLIANT - CORE**
  - 2021: 55%
  - 2020: 8%
  - $p < .001$
Total Bundle Compliance by Year

- **CORE STAFF**
  - 2021: 76%
  - 2020: 70%
  - $p = 0.022$

- **NON-CORE STAFF**
  - 2021: 24%
  - 2020: 30%

2021 vs. 2020
Implications

- Core vs. Non-Core
- Dashboard
- Continued education
- Continued auditing
Limitations

- Timeframe
- Generalize
- Manual extraction
Dissemination Plan

- Stakeholder Presentation
- Manuscript (Journal of Nursing Care Quality)
- Research Day Poster
Questions?
References

Available upon request