**Ventilator Bundle**

Prevent ventilator-associated pneumonia (VAP) and deaths from VAP and other complications in patients on ventilators by reliably implementing a set of evidence-based interventions known as the IHI Ventilator Bundle.

**Domain**

**Patient Care Processes:**
Clinical processes that ensure delivery of high-quality care to individual patients

**Aims**

**Effective:**
An evidence-based practice that produces better outcomes than its alternative

**Safe:**
Delivery of care in a manner that minimizes any risk of harm to a patient

**Process Attributes**

<table>
<thead>
<tr>
<th>$</th>
<th>Cost to Implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal: Just the cost of the improvement effort itself</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>🕒</th>
<th>Time to Implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer than 12 months</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>🗿</th>
<th>Difficulty to Implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderately Challenging: Either involves multiple units or disciplines OR requires a substantial shift in culture and/or operations, but not both of these</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>📄</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some Evidence: Level III — Studies published with some control included</td>
<td></td>
</tr>
</tbody>
</table>

**Details**

**Elements**

- **Implement the Ventilator Bundle:**
  - Elevation of the head of bed to between 30 and 45 degrees
  - Daily “sedation vacations” and assessment of readiness to extubate
  - Peptic ulcer disease prophylaxis
  - Deep venous thrombosis prophylaxis (unless contraindicated)
  - Daily oral care with chlorhexidine
• Make the process for delivering all bundle elements more reliable:
  • Include interventions on order sets for initiation and weaning of mechanical ventilation, delivery of tube feedings, and provision of oral care.
  • Implement a protocol to lighten sedation daily at an appropriate time to assess for neurological readiness to extubate. Include precautions to prevent self-extubation such as increased monitoring and vigilance during the trial.
  • Empower pharmacy to review orders for patients in the ICU to ensure that some form of peptic ulcer disease prophylaxis and deep venous thrombosis prophylaxis is provided for all appropriate patients at all times in the ICU.
  • Review all elements of bundle during multidisciplinary rounding.
  • Use visual cues so it is easy to identify when the bed is in the proper position, such as a line on the wall that can only be seen if the bed is below a 30-degree angle.

Outcomes

• Mortality (HSMR): Decreased mortality (hospital standardized mortality ratio, or HSMR)
• Harm: Decreased harm to patient (e.g., Harms per 100 patient days, as measured by the IHI Global Trigger Tool)
• Cost of Care: Decreased cost per inpatient case

Service Lines and Critical Functions

• Infection Prevention and Management
• Intensive Care

Key Measures

• Ventilator Bundle Compliance
  • Numerator: Number of intensive care unit patients on mechanical ventilator for whom all five elements of the Ventilator Bundle are documented and in place
  • Denominator: Total number of intensive care unit patients on mechanical ventilation
• Ventilator-Associated Pneumonia (VAP) Rate
  • Numerator: Ventilator-associated pneumonia (VAP) rate in ICU
  • Denominator: 1000 ventilator days
  • Based on CDC NHSN definition of VAP

Reasons and Implications

Importance for Patients and Families
Ventilator-associated pneumonia, one of the most serious complications for the most critically ill and vulnerable patients, can be avoided in the hospital by using proven interventions.

Requirement, Standards, Policies, and Guidelines

• Agency for Healthcare Research and Quality (AHRQ)

• National Priorities Partnership (NPP)
  Safety

• National Quality Forum (NQF)
  Safe Practice for Better Healthcare—2009 Update
  Safe Practice 11: Intensive Care Unit Care
  Safe Practice 23: Care of the Ventilated Patient

Financial Implications

• Expense reduction due to prevention of VAP, reduced length of stay, and reduced ventilator days.

Prerequisites

None for this process
Additional Resources

- **Centers for Disease Control and Prevention (CDC)**
  Guideline for Preventing VAP
- **Centers for Disease Control and Prevention (CDC)**
  Ventilator-Associated Pneumonia or Not? Contemporary Diagnosis
- **American Hospital Association (AHA)**
  Hospitals in Pursuit of Excellence – Individual Case Studies
  A Divide-And-Conquer Approach to VAP Prevention
  Woodhull Medical and Mental Health Center
- **Centers for Disease Control and Prevention (CDC)**
  An Overview of Ventilator-Associated Pneumonia
- **US Department of Health and Human Services**
  Partnership for Patients
- **Society of Hospital Medicine**
  Preventing Healthcare Acquired Infections
- **Society for Healthcare Epidemiology of America/Infectious Diseases Society of America (SHEA/IDSA)**
  Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals
- **American Hospital Association (AHA)**
  Hospitals in Pursuit of Excellence – Individual Case Studies
  Improving Care by Reducing VAP
  Bronson Methodist Hospital
- **The Joint Commission (TJC)**
  Patients as Partners in the Infection Prevention and Control Process
- **American Hospital Association (AHA)**
  Hospitals in Pursuit of Excellence – Individual Case Studies
  Team Work Prevents VAP
  San Antonio Community Hospital
- **American Hospital Association (AHA)**
  Hospitals in Pursuit of Excellence – Individual Case Studies
  Rooting Out VAP and Variability with Intensivists
  Saint Elizabeth Regional Medical Center

Information Compiled By

IHI