The Military Health System's

PARTNERSHIP FOR PATIENTS CAMPAIGN

SAFE CARE SAVES LIVES

Implementation Guide for Ventilator-Associated Pneumonia and Ventilator-Associated Events

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U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES

PARTNERSHIP FOR PATIENTS

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Contents

1. Introduction

This implementation guide was created to support the Partnership for Patients, a national initiative sponsored by the Department of Health and Human Services to reduce harm in health care facilities. Military Health System leadership has pledged its support to the PfP, and has made a commitment to specific, identified aims. Improving the quality and safety of health care in all Department of Defense facilities will only be possible with universal support at every level in the MHS.

This guide is one of 10 harm-specific guides designed to assist you as you implement identified evidence-based practices to improve patient care. Common to all guides are resources that support efforts to educate the health care team by providing MHS-selected EBPs and quality improvement strategies.

In addition, implementation strategies and tools relevant to all harm categories are included in a guide titled "Practical Applications for Process Improvement and Change Management." This guide supports efforts to equip the health care team with rapid-cycle process improvement methods and engage the health care team through the use of change management strategies.

2. Ventilator-Associated Pneumonia and Ventilator-Associated Events Surveillance Evidence-Based Practices

2.1 Background Information

Ventilator-Associated Pneumonia (VAP) and Ventilator-Associated Events (VAE) are nosocomial lung infections that occur in patients receiving mechanical ventilation. Pneumonia and events are considered ventilator-associated if the patient is intubated and ventilated at the time or within 48 hours before the onset of infection. The CDC notes there is no minimum period of time that the ventilator must be in place for the infections to be considered ventilator-associated (National Healthcare Safety Network Manual: Patient Safety Component Protocol).

In January 2013, CDC recommended that VAP protocol be used for neonatal and pediatric patients ONLY. At that time, the CDC modified the definitions for VAP for those patients on mechanical ventilation for patients 18 years of age or older. Ventilator Associated Events (VAE) represents a new approach that is focused on standardized methods, objectivity, and reliability. VAE identifies a broad range of events in patients on mechanical ventilation, not limited to VAP. Criteria for patients eligible for VAE Surveillance:

- ✓ ≥18 years of age
- ✓ Inpatients of acute care hospitals, long term acute care hospitals, inpatient rehabilitation facilities
- ✓ NOTE: Patients on high frequency ventilation or extracorporeal life support are EXCLUDED from VAE surveillance

2.2. VAE Definitions and Algorithms

While the definition of VAP in patients <18 years of age remains the same, the definition of VAE has changed. A summary of the definition algorithms and tiers follows:

Ventilator-Associated Events Definition Algorithm Summary

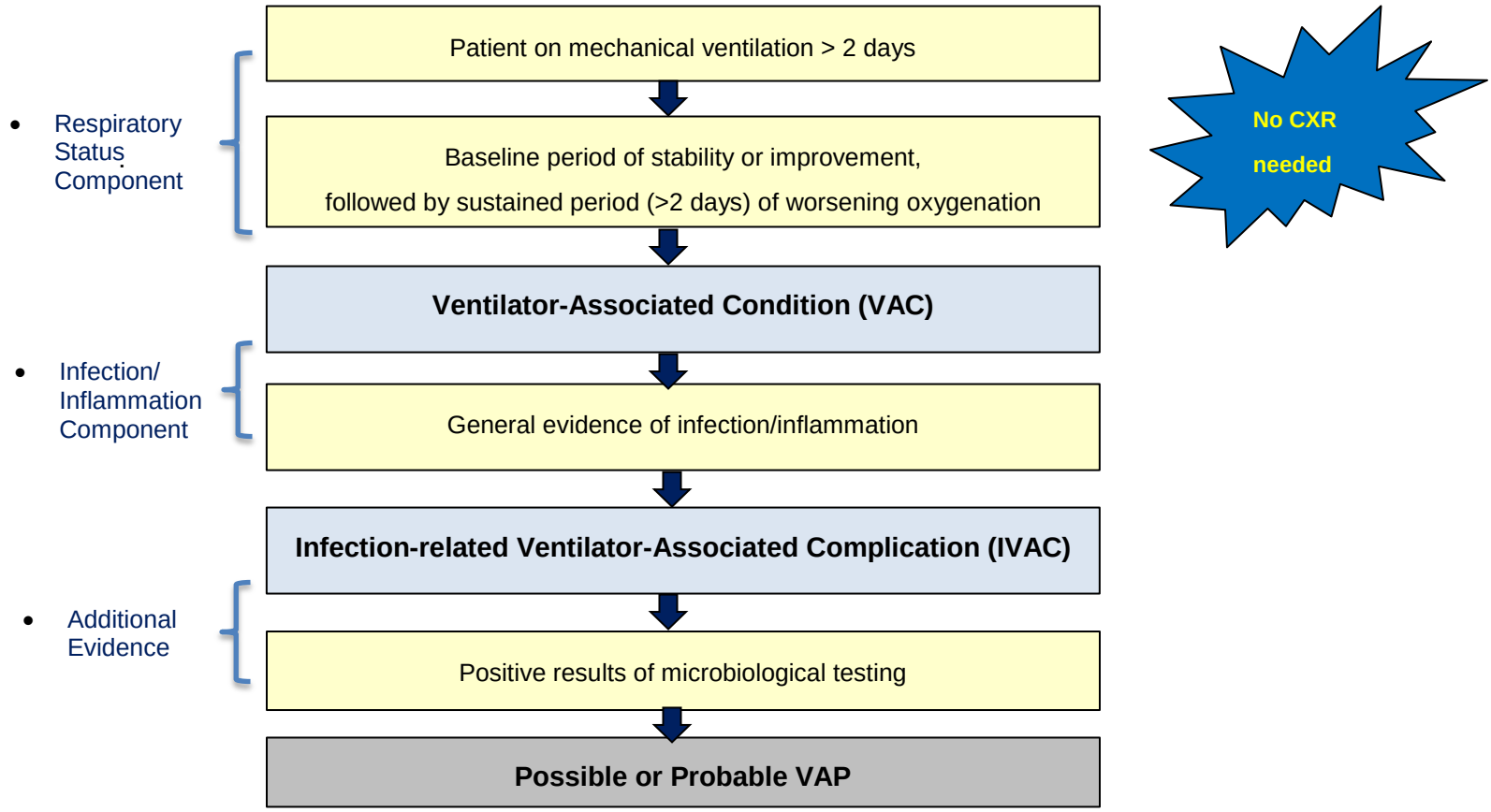

Figure 1: Ventilator-Associated Events (VAE) Surveillance Algorithm

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the two calendar days immediately preceding the first day of increased minimum PEEP or FiO_2. *Daily minimum defined by lowest value of FiO2 or PEEP during a calendar day that is maintained for at least 1 hour.

↓

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1. Increase in daily minimum FiO_2 of ≥ 0.20 (20 points) over the daily FiO_2 in the baseline period, sustained for ≥ 2 calendar days
2. Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP in the baseline period†, sustained for ≥ 2 calendar days

*Daily minimum defined by lowest value of FiO2 or PEEP during a calendar day that is maintained for at least 1 hour.
†Daily minimum PEEP values of 0-5 cmH_2O are considered equivalent for the purposes of VAE surveillance.

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Ventilator-Associated Condition (VAC)

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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 °C, or < 36 °C, OR white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3.

AND

2) A new antimicrobial agent/s is started, and is continued for ≥4 calendar days.

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Infection-Related Ventilator-Associated Complication (IVAC)

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On or after day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met:

1. Purulent respiratory secretory secretions (from one or more specimen collections
   - Defined as secretions from the lungs, bronchi, or trachea that contain ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field [lpf, x100]
   - If the laboratory reports semi-qualitative, those results must be equivalent to the above quantitative thresholds
   - See additional instructions on page 10-4 of 2014 NHSN Manual, Patient Safety Component Protocol
2. Positive culture (qualitative, semi-qualitative or quantitative) of sputum*, endotracheal aspirate*, bronchoalveolar lavage*, lung tissue or protected specimen brushing*.

*Excludes the following:

- Normal respiratory/oral flora, mixed respiratory/oral flora or equivalent
- *Candida* species or yeast not otherwise specified
- Coagulase-negative *Staphylococcus* species
- *Enterococcus* species

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Possible Ventilator-Associated Pneumonia

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met:
Purulent respiratory secretions (from one or more specimen collections – and defined as for possible VAP)
AND one of the following:

- Positive culture of endotracheal aspirate*, ≥ 10^5 CFU/ml or equivalent semi-quantitative result
- Positive culture of bronchoalveolar lavage*, ≥ 10^4 CFU/ml or equivalent semi-quantitative result
- Positive culture of lung tissue, ≥ 10^4 CFU/g or equivalent semi-quantitative result
- Positive culture of protected specimen brush*, ≥ 10^3 CFU/ml or equivalent semi-quantitative result

Same organism exclusions as noted for Possible VAP.

2. One of the following (without requirement for purulent respiratory secretions):

- Positive pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
- Positive lung histopathology
- Positive diagnostic test to *Legionella* spp.
- Positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza, rhinovirus, human metapneumovirus, coronavirus

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Probable Ventilator-Associated Pneumonia

2.3. Burden of Illness

According to the Institute for Healthcare Improvement, VAP and VAE are the leading cause of death amongst hospital-acquired infections, exceeding the rate of death due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient. Perhaps the most concerning aspect of VAP is the high associated mortality. Hospital mortality of ventilated patients who develop infection is 46 percent compared to 32 percent for ventilated patients who do not develop VAP or VAE.

VAP and VAE Burden of Illness

- Increases ventilators support and ICU stay by an average of 4.3 days
- Increases hospital length of stay by 4 to 9 days
- Increases cost by more than $40,000 per episode of hospital stay
- Is estimated to cost more than $1.2 billion nationally each year
- Is the leading cause of death among hospital-acquired infections

Sources:

1. IHI, How to Guide: Prevent Ventilator-Associated Pneumonia, Cambridge, MA, IHI: 2012.
2. Heyland, et al, American Journal of Respiratory and Critical care Medicine, (1999).
3. Craven, *Epidemiology of Ventilator-Associated Pneumonia*, CHEST Journal: 2000.
4. Rello, et al, Epidemiology and Outcomes of Ventilator-Associated Pneumonias in a Large US Database, CHEST Journal: 202.
5. Safder, et al, *Clinical and Economic Consequences of Ventilator-Associated Pneumonias: A Systematic Review,* Critical Care Review: 2005.

2.4 Risk Factors

There are a number of factors that can put a patient at risk for a VAP or VAE. The CDC has identified important risk factors including:

- Mechanical ventilation
- Pre-existing pulmonary conditions
- Large number of previous intubations

2.5 Evidence-Based Practice Guidelines and Bundle

To reduce the prevalence of VAP and VAE, best practices have been developed. They focus on three components: staff education, colonization and aspiration reduction and prevention

- ✓ Staff education
- ✓ Colonization reduction
  - Handwashing
  - Oral hygiene
  - Common suction protocol
  - Avoid saline lavage
  - Closed suction system
  - Stress ulcer prophylaxis (involve pharmacists)
- ✓ Aspiration reduction and prevention
  - Regular oral and subglottic suction
  - Elevation of head ≥ 30 degrees
  - Early extubation
    - Daily assessment of extubation readiness
    - Daily interruption of sedation

Source:

1. Theron Van Hooser, D. (2002) Ventilator-Associated Pneumonia (VAP) Best Practice Strategies for Caregivers. *Kimberly-Clark Health Care.*
National Guideline Clearinghouse. (2009) Strategies to prevent ventilator-associated pneumonia in acute care

In an effort to prevent infection, care management bundles have been created. ***A care bundle is a set of evidence-based interventions*** that, when used together, significantly improve patient outcomes.

The MHS has selected the Institute for Healthcare Improvement VAP bundle for implementation at Military Treatment Facilities:

MHS VAP and VAE Bundle (IHI)

- ✓ Elevate the head of the bed at least 30 degrees.
- ✓ Perform daily sedation interruption and daily assessment of readiness to extubate.
- ✓ Perform peptic ulcer disease prophylaxis.
- ✓ Perform deep venous thrombosis prophylaxis.
- ✓ Perform daily oral care with chlorhexidine.

Source:

IHI. *How-to Guide: Prevent Ventilator-Associated Pneumonia*. Cambridge, MA: IHI; 2012.

2.6 MHS VAP and VAE Prevention Performance Measures

MTFs are expected and encouraged to report facility-wide VAP data with the understanding that this will be limited to ICUs unless there is a long-term ventilator unit. The MHS has selected the following process and outcome measures to track performance:

Descriptions	Data Source	Metric
• Observation / Check list for bundle compliance	Essentris	Process Measure
• Ventilator-Associated Pneumonia Rate: [Incidence of VAP in each ICU] / [Number of ventilator days] x 1000	CDC/NHSN	Outcome Measure

3.0 References

Centers for Disease Control and Prevention (2003). Guidelines for Preventing Health-Care-Associated Pneumonia. *Center for Disease Control.* http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm Accessed 7/10/12.

Coffin, S. (2008). Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals. *SHEA/IDSA Practice Recommendation*.

Cook, J. (1994). Risk Factors for GI Bleeding in Crticially Ill Patients. *New England Journal of Medicine*.

Institute for Healthcare Improvement. (2012, February). How-to Guide: Prevent Ventilator-Associated Pneumonia. *Institute for Healthcare Improvement.* http://www.ihi.org/knowledge/Pages/Tools/HowtoGuidePreventVAP.aspx Accessed 7/10/12.

Kress, J. (2003). The Long-term Psychological Effects of Daily Sedation Interruption on Critically Ill Patients. *American Journal of Respiratory and Critical Care Medicine*.

Munro, C., Grap, M., Jones, D., McClish, D., & Sessler, C. (2011). Chlorhexidine, Toothbrushing, and Preventing Ventilator-Associated Pneumonia in Critically Ill adults. *American Journal of Critical Care*, 428-437.

NHSN Manual: Patient Safety Component Protocol, http://www.cdc.gov/nhsn/PDFs/pscManual/pcsManual_current.pdf Accessed 1/8/2014.

Ventilator-Associated Events (2013, January) www.cdc.gov/nhsn/psc_da_vae.html.

Ventilator-Associated Pneumonia (VAP) . (2012, January). www.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf Accessed 7/10/12.

4.0 Appendix: Attachment A: VAP/VAE Bundle Compliance Form

VAP Bundle – Compliance

Objective: To provide documentation of compliance with implementation of VAP/VAE prevention bundle.
Instructions: Assess guideline compliance on patients receiving mechanical ventilation.

Ventilator-Associated Pneumonia Prevention EBP Compliance Checklist	Yes	No	Identified Barriers/ Plans to Overcome Barriers
1. Elevation of the head of the bed at least 30 degrees.			
2. Perform daily sedation interruption and assessment of need to extubate patient.			
3. Perform peptic ulcer disease prophylaxis.			
4. Perform deep venous thrombosis prophylaxis.			
5. Perform daily oral care with chlorhexidine.			