Vanishing Ventilator-Associated Events
CentraCare St. Cloud Hospital
Essentia Health - Fosston

December 8, 2014
Minnesota hospitals that treat patients with ventilators began working on reducing VAP in their ICU’s and reporting their bundle data to MHA in 2009

VAP to VAE

The CHAIN VAE gap analysis was released in early 2013

HAI mini-grant funding created an opportunity to bring hospitals together to choose and pilot a succinct bundle of VAE interventions

MN CHAIN VAE gap analysis is being updated to align with the Vanishing VAE bundle in 2015

The Vanishing VAE bundle will be incorporated into the MHA SAFE Care road map in 2015
Rate of Ventilator-associated pneumonia among Minnesota HEN hospitals

87 (100%) of 87 applicable hospitals reporting 13% decrease

(Q4 2010 - Q1 2014)
Rate of Ventilator-associated pneumonia among Minnesota HEN hospitals reporting to NHSN
38 (86%) of PPS hospitals reporting 23% decrease
(Q1 2012 - Q4 2013)

Rate (per 1000 discharges)

40% reduction

4Q rolling avg

Quarter
(n = number of hospitals reporting)

Q1 2012 (n=37)
Q2 2012 (n=37)
Q3 2012 (n=37)
Q4 2012 (n=37)
Q1 2013 (n=38)
Q2 2013 (n=38)
Q3 2013 (n=38)
Q4 2013 (n=38)
Vanishing VAE participating hospitals

- St. Cloud Hospital
- Hennepin County Medical Center
- Sanford Health Bemidji
- Essentia Health Fosston
Objectives

• Identify the purpose of the Minnesota Hospital Association ventilator-associated events (VAE) project.
• Define ventilator-associated events (VAE).
• Identify the components to prevent VAEs based on the best evidence.
• Define best practices for patient transport to a higher level of care.
• Describe the process and outcome measures used to determine effectiveness of VAE management.
• Apply ventilator bundle components to a case study.
VAE Definition Presentation

Ellen Simonson, RN, CIC
Director, Infection Prevention and Control
CentraCare Health - St. Cloud Hospital
VAE Surveillance Criteria: BASIC

Eligible:
• Inpatient
• Location-based

Not Eligible:
• Ventilated < 3 days
• Pts on high frequency ventilation (HFV) or extracorporeal life support (ECLS)
VAE Surveillance Criteria: BASIC

• Ventilator
  – Intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (nasal PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are NOT considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP)
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, objective evidence of infection/inflammation
  - Infection-Related Ventilator-Associated Complication (IVAC)
  - Positive results of laboratory/microbiological testing
  - Possible or Probable VAP

Additional evidence
Ventilator-Associated Condition (VAC)

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥2 calendar days of stable or decreasing daily minimum $^6$ FiO$_2$ or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO$_2$.

$^6$Daily minimum defined by lowest value of FiO$_2$ or PEEP during a calendar day that is maintained for at least 1 hour.

AND

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 $^6$ FiO$_2$ of ≥0.20 (20 points) over the daily minimum FiO$_2$ in the baseline period, sustained for ≥2 calendar days.

2) Increase in daily minimum $^6$ PEEP values of ≥3 cmH$_2$O over the daily minimum PEEP in the baseline period$^7$, sustained for ≥2 calendar days.

$^7$Daily minimum defined by lowest value of FiO$_2$ or PEEP during a calendar day that is maintained for at least 1 hour.

$^6$Daily minimum PEEP values of 0-5 cmH$_2$O are considered equivalent for the purposes of VAE surveillance.
Infection-related Ventilator-Associated Complication (IVAC)

Patient meets criteria for VAC

AND

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.
Possible VAP

Patient meets criteria for VAC and IVAC

AND

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:

1) Purulent respiratory secretions (from one or more specimen collections)
   - 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).
   - If the laboratory reports semi-quantitative results, those results must be equivalent to the above quantitative thresholds.
   - See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol.

OR

2) Positive culture (qualitative, semi-quantitative 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
Probable VAP

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:

1) Purulent respiratory secretions (from one or more specimen collections—and defined as for possible VAP)

AND one of the following (see Table 2):
- Positive culture of endotracheal aspirate, $\geq 10^5$ CFU/ml or equivalent semi-quantitative result
- Positive culture of bronchoalveolar lavage, $\geq 10^4$ CFU/ml or equivalent semi-quantitative result
- Positive culture of lung tissue, $\geq 10^4$ CFU/g or equivalent semi-quantitative result
- Positive culture of protected specimen brush, $\geq 10^3$ CFU/ml or equivalent semi-quantitative result

*Same organism exclusions as noted for Possible VAP.*

OR

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 for *Legionella* spp.
- Positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus
VAE Pathophysiology Presentation

Melissa McClure, MD
Pulmonary/Critical Care
CentraCare Health
Ventilator-Associated Event: Definition

- Inclusive of all conditions that cause a “sustained increase in oxygenation support”
- Hypoxemia
- ≥ 20% increase in the daily minimum FIO2 or an increase in PEEP of 3 from previous
- Includes infectious and non-infectious causes
  - Pneumonia, tracheitis
  - Pulmonary edema, atelectasis or PE
VAE: 3 Tiers

1: Ventilator-associated condition (VAC): hypoxemia for 2 days
   • No consideration for cause of hypoxemia
   • Unsure yet if VAC events are preventable or reducible

2: Infection-related ventilator-associated complication (IVAC)
   • Hypoxemia with generalized infection or inflammation
   • Antibiotics are instituted for at least 4 days

3: Probable or possible ventilator-associated pneumonia (VAP)
   • Sputum gram stain with WBC or pathogen identification
   • Culture of respiratory pathogen with IVAC
   • Separates possible and probable
Ventilator-Associated Pneumonia (VAP)

- CDC definition 2002
- New or progressive and persistent radiographic abnormality developing in a patient on mechanical ventilation (or within 48 hours of mechanical ventilation)
- Must also demonstrate: one or more systemic signs (fever, leukopenia or leukocytosis, or altered mental status in those >70 years of age) and selected pulmonary criteria (eg, change in respiratory secretions, new onset of cough, dyspnea, rales, bronchial breath sounds, or worsening oxygenation)
- Not sensitive or specific
- Not helpful for surveillance
VAP

• Most common nosocomial infection in the ICU
• Significant morbidity and mortality
• Prevention strategies work best if based on pathophysiology
• Acquisition:
  – Oropharyngeal colonization of normal flora or acquired ICU pathogens: hand hygiene, air or water
  – Stomach: gram negatives
  – Biofilms on ET tubes (late onset VAP) or tracheal colonization
• Aspiration around ETT cuff leads to VAP
• Lower respiratory tract typically sterile
• Epidemic VAP: contaminated equipment, water or air
• Routine surveillance of VAP is mandatory
How VAP starts: AEIOU and WHY

- Aspiration
- Extension
- Inhalation
- Hematogenous
- Leads to the WHY
Fig. 1. Routes of colonization/infection in mechanically ventilated patients. Colonization of the aerodigestive tract may occur endogenously (A and B) or exogenously (C through F). Exogenous colonization may result in primary colonization of the oropharynx or may be the result of direct inoculation into the lower respiratory tract during manipulations of respiratory equipment (C), during using of respiratory devices (E), or from contaminated aerosols (F).
Host Defense

- Large airway barriers
  - Coughing
  - Mucociliary clearance
- Lung barriers
  - Macrophages
  - Cellular and humoral
- Ventilator effect
  - Decreased cough
  - Tracheal irritation
  - Direct extension via ETT
Hospital Response to VAP: Bundles

- Elevate HOB typically (30° to 45°): prevent aspiration
- Chlorhexidine mouth cares: oropharyngeal decontamination
- Lung protective ventilation strategies
- Appropriate analgesia and sedation/vacations
- Subglottic suctioning
- Early extubation when ready
- Early mobilization
- Deep venous thrombosis prophylaxis
- Gastrointestinal prophylaxis
Bundle Components

Joe Wilson, RN, BSN, CCRN
Intensive Care Unit
CentraCare Health - St. Cloud Hospital
Ventilator Settings

- Maintain tidal volumes < 8 ml/kg
- Maintain plateau pressures < 30 cm H₂O
  - Reduces risk of ventilator associated acute lung injury.
  - Assess plateau pressures frequently and make volume adjustments accordingly.
  - Set peak pressure alarms accordingly to identify rising trends
Sedation

• Goal of sedation should be to use the least amount of sedation possible to achieve respiratory stability, ventilator synchrony, and minimal patient anxiety.
  – Specific to patient needs
  – Sedation vacation protocols
  – Use of sedation scores and set goals
  – Sedation strategies may vary
Sedation Strategies

• No sedation
• Intermittent sedation
• Continuous sedation with twice daily interruption
• Continuous sedation without interruption
  – Use should be only in extreme cases of hemodynamic, neurological, or respiratory instability or when administering neuromuscular blockade.
Benefits to an Awake Patient

• Patient participation
  – Plan of care
  – PT/OT and mobility
  – Bowel and bladder function
  – Less medication and metabolites
  – Earlier recognition in neurological changes or patient reported symptoms
  – Ease in coordinating spontaneous breathing trials
Disadvantages to an Awake Patient

• May require 24° sitter to monitor fluctuating mentation and prevent unplanned removal of endotracheal tube or other devices
• Anxiety related to mechanical ventilation or disease state
• Inability to synchronize breathing with ventilator
• Families perception of patient comfort
Nurse and RT Driven Mechanical Ventilation Protocols

- Order sets and guidelines for nurse and RT driven ventilator management, vent weaning and extubation practices
  - Research shows decreased ventilation time and improves patient outcomes
  - Protocol elements (vary by institution)
- Barriers
  - Comfort level and experience
  - Worries of failing
  - Negative feedback
- Overcoming Barriers
Spontaneous Breathing Trials

• Coordinate with sedation vacations twice daily
• Set apnea alarm for safety
• Vent settings may vary by protocol  
  – CPAP or pressure support 0-12 cm H₂O  
• Should be limited to 30-60 minutes  
  – Research may vary slightly but shows 30 minutes is adequate  
  – Prolonged trials may lead to fatigue
Bundle Components

Paige Mechtel, RN, BSN
Intensive Care Unit
CentraCare Health - St. Cloud Hospital
Oral Care

• Ensure oral care completion Q2 - Q4 hours
  – Prior to repositioning, activity, or change in HOB elevation

• Oral care with 0.12% Chlorhexidine BID
  – Reduces the bacteria on the oral mucosa and the potential for bacterial colonization in the upper respiratory tract (VAE Prevention Strategies, 2014).

• Ensure subglottic suctioning Q6H and PRN
  – Minimizes pooling of secretions above endotracheal tube cuff
  – Consider continuous subglottic suction for copious secretions, prolonged intubation, oral, trauma, etc...
  – Shown to reduce VAP rates, mechanical ventilation days, and ICU length of stay (SHEA, 2014).
Oral Care

• Who is responsible for oral care practices?
  – Develop a collaboration between staff (RNs, RTs, & nursing assistants) to ensure oral care completion
  – Education of staff on rational supporting proper oral care is essential

• Documentation
  – Ensure documentation of oral care (including Chlorhexidine use and subglottic suctioning) in electronic health record
  – Monitor oral care practices
HOB Elevation

- Ensure HOB elevation at 30-45° for ventilated patients, unless contraindicated
  - Facilitates work of breathing/coughing
  - Prevents aspiration of tube feedings and secretions
  - HOB elevation is a simple task with minimal risk & cost, and potential benefit
    (SHEA, 2014)
HOB Elevation

• Problematic patient populations to maintain HOB elevation
  – Spinal cord injuries
  – Unstable fractures
  – Obesity
  – Uncontrolled pain
  – Hemodynamic instability

• How to ensure HOB practice
  – Staff training and collaboration
  – Inclusion of HOB guidelines in ventilator order sets
  – Visual cues and reminders
  – Consistent place to document in electronic health record
  – Daily monitoring
HOB Elevation

• Who is responsible for HOB elevation?
  – Develop a collaborative plan between RNs, RTs, PTs and other support staff
• Encourage EMS teams to elevate HOB during transport
  – Explain beneficial rational and contraindication
  – Does their equipment allow for HOB elevation?
  – Manage patient comfort during transport to allow for HOB elevation
Early Progressive Mobility

• Early progressive mobilization prevents VAE by maintaining or improving physical condition
  – Ability to wean and extubate earlier
  – Decreases hospital length of stay and overall cost
  – Increases the rate of return to normal function (SHEA, 2014)

• Prolonged immobility has been linked to:
  – Ventilator associated pneumonia
  – Hospital acquired complications (Clark et al., 2013)
    • Neuropathies
    • DVTs
    • Pressure ulcers
    • Prolonged ventilation
    • Psychological disturbances
Early Progressive Mobility

• Why is it important?
  – Negative effect on cardiovascular and pulmonary systems (Ronnebaum et al., 2012)
  – Prolonged immobility leads to
    • Intolerance of physical activity, including sitting upright
    • Lack of ability to aerate lungs
    • Development of VAE and thromboemboli (Ronnebaum et al., 2012)
Early Progressive Mobility

- There is evidence to support it as a “best practice”
  - There are numerous published studies supporting the practice of early mobility.
  - St. Cloud Hospital mobility protocol
    - Reduced hospital LOS by 18%
    - Reduced ventilator hours by 16%
    - Improved discharges to home by 9.2%
    - Reduced hospital cost by 5.7%
St. Cloud Hospital
Standard for Progressive Mobility Guideline

**STANDARD FOR PROGRESSIVE MOBILITY GUIDLINES**

**Standards for all patients:**
- Complete bed rest orders for prolonged periods should be a rare exception and should be questioned if a legitimate reason is not apparent.
- Turn every two hours on bed rest (document if contraindicated or patient not tolerating).
- Brief ROM with turns on all patients who cannot actively participate in their care.
- Maintain HOB of > 30 degrees for ventilated patients, unless contraindicated.
- Document barriers limiting progression of mobility.

**Exclusions from progressive mobility:**

The list below is not all-inclusive. **CLINICAL JUDGEMENT** should always be used regarding the appropriateness of mobilizing patients. The overall goal is to mobilize as many patients as possible while maintaining SAFETY!

**Cardiovascular:**
- < 1/2 max dose of one vasopressor
- Unstable tachycardia/arrhythmia
- Unstable blood pressure
- Unstable anemia
- Acute PE/DVT’s 24 hours

**Respiratory:**
- PEEP’s 10 cm H2O
- FIO2 ≥ 60%
- SaO2< 90% with exception of patients that are clinically stable below 90%

*Consider abnormal lab values (i.e. Hgb, clotting factors, etc...)*

**IF NO EXCLUSIONS**

**PROGRESS MOBILITY**

- **Level 1**: Clinical stability and able to move arm against gravity
  - Sitting position 20 min TID (cardiac chair or biodynamic)

- **Level 2**: Sitting upright and able to move legs against gravity
  - Sitting on edge of bed (angle)

- **Level 3**: Increased strength and stands with minimal to moderate assistance
  - Active transfer to chair or 20 min 2 s/day (must use assistive devices)

- **Level 4**: Strength and distance walking
  - Ambulation (walking in place, walking in halls)
Progressive Mobility Guideline

STANDARD FOR PROGRESSIVE MOBILITY GUIDELINES

Standards for all patients:

- Complete bed rest orders for prolonged periods should be a rare exception and should be questioned if a legitimate reason is not apparent.
- Turn every two hours on bed rest (document if contraindicated or patient not tolerating).
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Progressive Mobility Guideline

Exclusions from progressive mobility:
The list below is not all-inclusive. CLINICAL JUDGEMENT should always be used regarding the appropriateness of mobilizing patients. The overall goal is to mobilize as many patients as possible while maintaining SAFETY!

Cardiovascular:
- < ½ max dose of one vasopressor
- Unstable tachycardia/arrhythmia
- Unstable blood pressure
- Unstable angina
- Acute PE/DVT ≤ 24 hours

Respiratory:
- PEEP ≥ 10 cm h2o
- FiO2 ≥ 60%
- SaO2 < 90% with exception of patients that are clinically stable below 90%

Consider abnormal lab values (i.e. Hgb, clotting factors, etc...)
Progressive Mobility Guideline

<table>
<thead>
<tr>
<th>Level</th>
<th>Goal: Clinical stability and able to move arm against gravity -Sitting position 20 min TID (cardiac chair or biodyne).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Goal: Sitting upright and able to move legs against gravity -Sitting on edge of bed (dangle).</td>
</tr>
<tr>
<td></td>
<td>Goal: Increased strength and stands with minimal to moderate assist -Active transfer to chair ≥ 20 min 2 x/day (may need assistive devices).</td>
</tr>
<tr>
<td></td>
<td>Goal: Strength and distance walking -Ambulation (marching in place, walking in halls).</td>
</tr>
</tbody>
</table>
Implementation

• Protocol development
  – Determine model and needs of mobility protocol
  – Collaborate among nursing, respiratory therapy, physical therapy, and physicians
  – Consider adding progressive mobility to ventilator order sets
  – Ensure appropriate charting capabilities in health record

• Personnel and physical resources
  – Ensure that you have appropriate staff
  – Ensure that you have appropriate equipment
Implementation

• Staff education
  – Identify education needs and rational
  – Provide initial and ongoing training and resources

• Staff support
  – Engage staff to participate in assisting with development, training, and execution of protocol
  – Ensure leadership support and presence

• Communication and collaboration
  – Consider including mobility in daily rounds discussion
  – Add mobility to plan of care
  – Continual assessment and analysis of protocol and make changes as necessary (Clark et al., 2013)
Additional Resources

• “ABCDE Bundle”
  – Critical Care Nurse-AACN
    http://ccn.aacnjournals.org/content/32/2/35.full.pdf+html

• Early Mobility Toolkit
  – Armstrong Institute for Patient and Quality-John Hopkins Medicine
    https://cdn.community360.net/app/jh/CMV/earlyMobility/CMV_Early_Mobility_Toolkit_2014.06.28.pdf

• Early Mobility in the ICU, How is it Going?
  – UCSF Critical Care & Trauma Medicine Conference
Essentia Health – Fosston
Joan Brown, RT
Essentia Health - Fosston

- 25 bed Critical Access Hospital
- ED/Level IV Trauma Center
- Anesthesiology
- Birthing Center
- Dietitian (Hospital)
- Ear, Nose & Throat / Otolaryngology
- Emergency Medicine
- Family Medicine / Primary Care
- Home Health Services

- Orthopedics / Orthopedic Surgery
- Podiatry
- Radiology / Imaging Services
- Rehabilitation Services (Hospital)
- Social Services (Hospital)
- Surgery (General)
  - ENT Surgery
  - Gynecological Surgery
Rural Considerations

- Mechanical ventilation in rural facilities is more often initiated only long enough to transfer patients to a larger hospital.
- The Vanishing VAE bundle elements also apply to BIPAP, and in rural facilities this may be the only form of mechanical ventilation utilized.
- Where staff involvement with mechanical ventilation is infrequent, it is helpful to conduct simulation exercises.
VAE Simulation Tool

• A VAE simulation tool has been developed to assist CAH in maintaining competency with mechanical ventilation
• Thank you to Tammy Hale from TriCounty Hospital for helping develop the tool.
Rural-Relevant Bundle Elements

- Use tidal volume of less than 8 ml/kg
- Elevation of the Head of the Bed 30-45 degrees including during patient transport
- Q4h Oral Care with Chlorhexidine bid
- Subglottic suctioning, continuous or intermittent at least q6h, and prn
  - For patients likely to require > 48 – 72 hour intubation, consider endotracheal tubes with subglottic secretion drainage ports.
- Consider managing ventilated patients without sedation or with intermittent or minimal sedation whenever possible
Process and Outcome Measures

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Care Center Director; Intensive Care /Surgical Care and Clinical Practice
CentraCare Health - St. Cloud Hospital
St. Cloud Hospital

- St. Cloud Hospital – 489 beds
  - Part of CentraCare Health
  - Magnet Designated – 3 times consecutively
  - Level II Trauma Center
  - One of 50 Top Cardiovascular Hospitals® by Truven
  - 100 Top Hospitals (eight-time honoree) by Truven
  - U.S. News & World Report "America's Best Hospitals"
    - Ear, Nose and Throat
    - Orthopedics
    - Urology
  - 2 adult critical care units, 1 pediatric ICU
  - 4 progressive care units (medical, surgical, neuro, pediatric)
St. Cloud Hospital
Intensive Care Unit

• 28 bed multi-specialty ICU (multisystem failure; trauma; neurology including interventional, surgical and acute stroke; pulmonary; renal; cardiovascular surgery)
• Gold Level Beacon ICU designation by the American Association of Critical-Care Nurses
• Intensivist program since 2004
• Hospitalist program
• Multidisciplinary rounds
• Evidence-based, protocol driven practices
## Process Measures
(for patients ventilated >24 hours)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Numerator</th>
<th>Denominator</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of bed elevation</td>
<td># of times HOB &gt; 30° (direct observation), excluding patients with contraindications</td>
<td># of HOB elevation observations, excluding patients with contraindications</td>
<td>Sample 30 per month</td>
</tr>
<tr>
<td>Oral care q 4 hrs and CHG used q 12 hrs (look back at last 24 hours)</td>
<td># of patients receiving oral care appropriately</td>
<td># of patients monitored</td>
<td>Sample 30 per month</td>
</tr>
<tr>
<td>Patients Sedated</td>
<td>Number of patients with sedation</td>
<td>Number of ventilated patients</td>
<td>Sample 30 per month</td>
</tr>
</tbody>
</table>
# Process Measures
(for patients ventilated >24 hours)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Numerator</th>
<th>Denominator</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily sedation vacation</td>
<td># of patients with intentional sedation weaning, excluding patients with</td>
<td># of patients expected to have intentional</td>
<td>Sample 30 per month</td>
</tr>
<tr>
<td>(direct observation)</td>
<td>contraindications (include patients with RASS score of zero)</td>
<td>sedation weaning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily assessment of readiness to</td>
<td># of patients with assessment of readiness to wean, excluding patients</td>
<td># of patients expected to have assessment of</td>
<td>Sample 30 per month</td>
</tr>
<tr>
<td>wean</td>
<td>wean, excluding patients with contraindications</td>
<td>readiness to wean</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subglottic suctioning q12 hrs</td>
<td># of patients with subglottic suctioning q12 hrs</td>
<td># of patients expected to have subglottic</td>
<td>Sample 30 per month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suctioning</td>
<td></td>
</tr>
</tbody>
</table>
## Process Measures
(for patients ventilated >24 hours)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Result</th>
<th>Report</th>
</tr>
</thead>
</table>
| Mobility progression (stand, chair, ambulate, edge of bed) | Report day of mobility as:  
1 – day of ventilator placement  
2 – first day after ventilator placement  
Etc.  
X – No out of bed mobility while ventilated  
NA – hemodynamic instability prevented mobility while ventilated | Sample 20 per month          |
Outcome Measures
(patients ventilated ≥ 2 calendar days)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Numerator</th>
<th>Denominator</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVACs (#IVAC/1000 ventilator days)</td>
<td># of IVACs</td>
<td># ventilator days x1000</td>
<td>IVACs on all adult ventilated patients per month</td>
</tr>
<tr>
<td>VACs rate (#VACs/1000 ventilator days)</td>
<td># of VACs</td>
<td># ventilator days x1000</td>
<td>VACs on all adult ventilated patients per month</td>
</tr>
</tbody>
</table>
### St. Cloud Hospital
### ICU Patient Demographics

<table>
<thead>
<tr>
<th></th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15 YTD (Jul14-Sep14)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td>2,064</td>
<td>2,295</td>
<td>2,474</td>
<td>625</td>
</tr>
<tr>
<td><strong>Length of Stay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Hospital LOS</td>
<td>8.92</td>
<td>8.62</td>
<td>8.59</td>
<td>8.12</td>
</tr>
<tr>
<td>Range</td>
<td>1-74</td>
<td>0-95</td>
<td>0-66</td>
<td>0-54</td>
</tr>
<tr>
<td>Average Intensive Care LOS</td>
<td>2.64</td>
<td>2.72</td>
<td>2.64</td>
<td>2.43</td>
</tr>
<tr>
<td>Range</td>
<td>0-53</td>
<td>0-43</td>
<td>0-39</td>
<td>0-26</td>
</tr>
<tr>
<td>Mechanically Ventilated Patients</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ventilator Utilization Ratio</td>
<td>0.66</td>
<td>0.69</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>(Vent Days/Patient Days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vent Hours Avg.</td>
<td>59.09</td>
<td>63.01</td>
<td>67.32</td>
<td>54.10</td>
</tr>
</tbody>
</table>
St. Cloud Hospital
VAE Measure Results

ICU Possible/Probable Ventilator Associated Pneumonia

- # of Possible VAP
- # of Probable VAP
# St. Cloud Hospital VAE Measure Results

<table>
<thead>
<tr>
<th>Measure</th>
<th>September ‘14</th>
<th>October ‘14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of bed elevation</td>
<td>n= 28 93%</td>
<td>n= 28 100%</td>
</tr>
<tr>
<td>Oral care</td>
<td>n= 30 100%</td>
<td>n= 30 83%</td>
</tr>
<tr>
<td>Patients Sedated</td>
<td>n= 30 100%</td>
<td>n= 30 63%</td>
</tr>
<tr>
<td>Daily sedation vacation</td>
<td>n= 29 100%</td>
<td>n= 29 100%</td>
</tr>
<tr>
<td>Daily assessment of readiness to wean</td>
<td>n= 27 100%</td>
<td>n= 26 100%</td>
</tr>
<tr>
<td>Subglottic suctioning q12 hrs</td>
<td>n= 30 100%</td>
<td>n= 30 93%</td>
</tr>
<tr>
<td>Mobility progression</td>
<td>Day 4.1</td>
<td>Day 6.5</td>
</tr>
<tr>
<td>Possible VAP/1000 ventilator days</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Probable VAP/1000 ventilator days</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
VAE Case Study

Melissa Fradette, MSN, RN, CCRN
Nurse Clinician, ICU
St. Cloud Hospital, St. Cloud, MN
Case Study – Mr. M

- Admitted for hypotension after presenting to the ED with nausea, vomiting, diarrhea, and productive cough
- Intubated and placed on the ventilator bundle
  - Initial ventilator settings were a TV of 7 ml/kg, FiO2 0.70, and PEEP of 5 cm H2O
  - Initiation of oral care completion q 2 hours; subglottic suctioning q 6 hours and prn; BID chlorhexidine application
  - HOB elevated 30-45°
  - Intermittent sedation utilized minimally for ventilator tolerance
- Day 2
  - FiO2 is decreased to 0.35
  - With the assistance of PT patient dangle at edge of bed
- Day 4 and Day 5
  - FiO2 increased to 0.45 and 0.50 respectively
  - Pt assisted up to the chair; increase in FiO2 attributed to increase in activity
Case Study – Mr. M

- **Day 7**
  - PEEP increased from 5 to 8 cm H2O
  - Temperature exceeds 38°C (100.4°F)
  - A qualifying antibiotic was initiated and continued for one week
  - Secretions from ETT sent to lab for sputum gram stain and culture

- **Day 8**
  - No change in PEEP or FiO2 levels
  - Bronchoscopy performed and specimens sent to lab
Does Mr. M Meet VAC Criteria?

• Was he mechanically ventilated for at least 2 calendar days?
  – Yes
• Was there an increase in the minimum daily FiO\textsubscript{2} of 0.20 or more from baseline or a PEEP increase of 3 cm H\textsubscript{2}O or more following 2 days of stable or decreasing levels?
  – Yes
• Were the increased FiO\textsubscript{2} or PEEP levels sustained for 2 calendar days?
  – Yes for the PEEP levels
Does Mr. M meet IVAC Criteria?

- Is there a temperature greater than 100.4°F or less than 96.8°F?
  - Yes
- Is the WBC count greater than 12,000 cells/mm³ or less than 4,000 cells/mm³?
  - No
- Was a new antimicrobial agent started and continued for 4 or more calendar days?
  - Yes
Does Mr. M Meet Possible/Probable VAP Criteria?

• Were purulent secretions present?
  – Yes; contained ≥ 25 neutrophils and ≤ 10 squamous cells per low power field (lpf, X100)

• Were the bronchoscopy aspirates positive?
  – Yes; positive culture for Pseudomonas aeruginosa via bronchoalveolar lavage at $10^4$ CFU/mL
References


Wang, J., Ma, Y., & Fang, Q. (2013). Extubation with or without spontaneous breathing trial. Critical Care Nurse, 33(6), 50-55. doi:10.4037/ccn2013580
Vanishing VAE Web Page

- MHA VAE web page at www.mnhospitals.org
- Questions?

Thank you