Implementation Guide to Prevention of Ventilator-Associated Pneumonia (VAP)

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REFERENCES
Prevention of Ventilator Associated Pneumonia Overview

Background:
- Ventilator Associated Pneumonia (VAP) is a high-risk disease for patients on mechanical ventilation. Attributable mortality may be as high as 40%.
- VAP is the leading cause of death among hospital-acquired infections, exceeding the rate of death due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient.
- VAP also prolongs time spent on the ventilator, length of ICU stay, excess use of antimicrobial medications and length of hospital stay after discharge from the ICU.
- For 2010, NHSN facilities reported more than 3,525 VAPs and the incidence for various types of hospital units ranged from 0.0-5.8 per 1,000 ventilator days.
- The total annual direct medical costs for VAP in United States hospitals is $1.03 billion to $1.50 billion.

Suggested AIM:
Decrease the rate of VAP to a state median of 0.0/1,000 ventilator days for at least 6 months by December 31, 2013

Potential Measures:

Outcome: VAP rate (number of VAPs per 1,000 ventilator days) for ICU and high-risk nursery (HRN) patients

Process: Ventilator Bundle Compliance (individual bundle element compliance, all-or-none bundle element compliance)

<table>
<thead>
<tr>
<th>Primary Drivers</th>
<th>Secondary Drivers</th>
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<tbody>
<tr>
<td>Elevate Head of Bed raised between 30-45 degrees</td>
<td>✓ 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.</td>
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<tr>
<td></td>
<td>✓ Include the clues on order sets for initiation and weaning of mechanical ventilation, delivery of tube feedings, and provision of oral care.</td>
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<td>✓ Create an environment where respiratory therapists work collaboratively with nursing to maintain head-of-the-bed elevation.</td>
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<tr>
<td>Peptic ulcer disease (PUD) prophylaxis</td>
<td>✓ The use of medications (H2 blockers are preferred over sucralfate). Proton pump inhibitors may be efficacious and an alternative to sucralfate or H2 antagonist.</td>
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<td></td>
<td>✓ Include PUD on the ICU order admission set and ventilator order set.</td>
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<td></td>
<td>✓ Incorporate review of PUD into daily multidisciplinary rounds.</td>
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<td>✓ Engage pharmacy in daily multidisciplinary rounds to ensure ICU patients have some form of PUD and VTE prophylaxis.</td>
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<tr>
<td>Venous Thromboembolism (VTE) prophylaxis</td>
<td>✓ Initiate VTE prophylaxis on all mechanically ventilated patients unless contraindicated.</td>
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<td>✓ Include VTE prophylaxis as part of your ICU order admission set and ventilator order set.</td>
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<tr>
<td>Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT)</td>
<td>✓ Develop protocols, order sets, and standard work for spontaneous swakening trials (SAT) and spontaneous breathing trial (SBT)</td>
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<td>✓ Perform daily assessments of readiness to wean and extubate.</td>
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<td>✓ Create an environment where respiratory therapists work collaboratively with nursing to facilitate a daily “sedative interruption” in coordination to “weaning trials.”</td>
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<td>✓ Implement a protocol to lighten sedation daily to assess for readiness to extubation. Include precautions to prevent self-extubation such as increased monitoring during the trial.</td>
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<tr>
<td>Oral Care</td>
<td>✓ Perform regular oral care with an antiseptic solution, e.g. chlorhexidine, in accordance with the manufacturer’s product guidelines.</td>
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<td></td>
<td>✓ Include daily oral care with chlorhexidine as part of your ICU order admission set and ventilator order set</td>
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<tr>
<td></td>
<td>✓ Educate the RN staff about the rationale for supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia.</td>
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Making Changes:
This intervention is in the Collaborative with Reducing Infections (Stay FIT Collaborative). National meetings, webinars, monthly coaching calls, change packages and other tools will augment state hospital association activities.

Key Resources:
- CDC Guidelines for Preventing VAP: http://www.cdc.gov/mmwr/preview/mmwrhtml/00045365.htm
- Society of Hospital Medicine Guidelines for Preventing VAP: http://www.hospitalmedicine.org/AM/Template.cfm?Section=CME&Template=/CM/HTMLDisplay.cfm&ContentID=4124
- IDSA and SHEA Compendium on VAP: http://www.jstor.org/stable/10.1086/591062
**Prevention of Ventilator Associated Pneumonia (VAP) Driver Diagram**

**2012-2013**

**AIM:** Decrease the rate of VAP to a state median of 0.0/1,000 ventilator days for at least 6 months by December 31, 2013.

<table>
<thead>
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<th>Change Ideas</th>
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| Elevate Head of Bed raised between 30-45 degrees. | • Use visual cues so it is easy to identify when the bed is in the proper position.  
• Identify one person to check for visual cues every one to two hours in the entire unit.  
• Include the cues on order sets for initiation and weaning of mechanical ventilation, delivery of tube feedings, and provision of oral care.  
• Educate patients and their families on the importance of keeping the head of the bed elevated. | ✓ Use a line (red tape) on the wall that can only be seen if the bed is below a 30-degree angle.  
✓ A string hanging on the side of the bed to show the correct angle.  
✓ Assign respiratory therapy staff or unit assistant to look for visual cues every one to two hours.  
✓ If computerized, use a pop-up reminder that is computer based.  
✓ Include the intervention on nursing flow sheets.  
✓ Discuss during multidisciplinary rounds.  
✓ Include HOB elevation in charge nurse rounds. Charge nurse can provide just in time training, if charge nurses are utilized. |
| Peptic ulcer disease (PUD) prophylaxis | • Use appropriate medications  
• Include PUD on the ICU order admission set and ventilator order set.  
• Engage pharmacy to ensure ICU patients have some form of PUD prophylaxis (redundancy, failure remediation)  
• Include PUD Rx on daily checklist. | ✓ H2 blockers are preferred over sucralfate. Proton pump inhibitors may be efficacious, and an alternative to sucralfate or H2 antagonist.  
✓ Discuss during multidisciplinary rounds.  
✓ Include PUD in charge nurse rounds. Charge nurse can provide just in time training and assist bedside nurse in obtaining order for PUD, if charge nurses are utilized. |
| Venous Thromboembolism (VTE) prophylaxis | • Initiate VTE prophylaxis unless the patient is contraindicated.  
• Engage pharmacy to ensure ICU patients have some form of PUD prophylaxis (redundancy, failure remediation)  
• Include VTE Rx on daily checklist. | ✓ Include VTE prophylaxis as part of your ICU order admission set and ventilator order set.  
✓ Include VTE in all ICU rounds. Nurse leaders can provide just in time training and assist bedside nurse in obtaining order for VTE prophylaxis. |
| Spontaneous awakening trials (sedation vacation)/ spontaneous breathing trials | • Develop protocols, order sets, and standard work for spontaneous awakening trials (SAT – also called sedation interruption or vacation) and a spontaneous breathing trial (SBT).  
• Coordinate SAT and SBT to maximize weaning | ✓ Perform daily assessments of readiness to wean and extubate.  
✓ Provide a daily reduction or removal of sedative support.  
✓ Consider one time of day that the SAT and SBT are attempted.  
✓ Coordinate between nursing and respiratory therapy on managing SAT and SBT. Use white boards, EMR or other |
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<th>Change Ideas</th>
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<tr>
<td></td>
<td>opportunities when patient sedation is minimal.</td>
<td>communication tools to enhance verbal coordination.</td>
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<tr>
<td></td>
<td>• Sedation should be goal oriented.</td>
<td>✓ Discuss the results of SAT and SBT during daily multidisciplinary rounds.</td>
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<tr>
<td></td>
<td></td>
<td>✓ SAT and SBT should be included in nurse to nurse handoffs, nurse to charge nurse report, and charge nurse to charge nurse report (if they occur).</td>
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<tr>
<td></td>
<td></td>
<td>✓ Administer sedation using goal according to a scale such as a RASS or Modified Ramsey Score as ordered by MD.</td>
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| Oral Care | Perform regular oral care with an antiseptic solution, brush teeth, and perform oral and pharyngeal suctioning | ✓ Tooth brushing twice a day as part order sets for all ventilated patients. |
|          | • Educate the RN staff about the rationale supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia | ✓ Include routine (every two to four hours) oral care with antiseptic mouthwash swab to clean oral cavity and teeth. |
|          | | ✓ Chlorhexidine 0.12% mouthwash at least daily (many studies site every 12 hours) as part of order sets for all ventilated patients. |
|          | | ✓ Create visual cues (e.g., empty holders of oral care products) indicating compliance with oral care. |
|          | | ✓ Include respiratory therapy in performing oral care; make it a joint RN and RT function. |

1 Richmond Agitation Sedation Scale (RASS)
Prevention of Ventilator-Associated Pneumonia (VAP)

Mechanically ventilated patients are at high risk for complications. These risks include VAP, peptic ulcer disease (PUD), gastrointestinal bleeding, aspiration, venous thromboembolic events (VTE) and problems with secretion management. Evidence-based interventions can reduce the risk of these complications and reduce the occurrence of VAP. Implementing the ventilator bundle has shown to reduce VAP. The VAP prevention bundle includes: head of bed elevated 30 to 45 degrees, oral care with chlorhexidine 0.12%, peptic ulcer prophylaxis, deep vein thrombosis prophylaxis, spontaneous waking trials and spontaneous breathing trials. This guide explores evidence-based practice for VAP reduction.

Suggested AIMs

Before the implementation work starts, the team must have a goal at which to aim. An AIM statement for VAP reduction efforts could include one of the following:

- Decrease the rate of VAP to a state median of 0.0/1,000 ventilator days (or state mean <1.0/1000 ventilator days) for at least 6 months by December 31, 2013
- Decrease the rate of VAP by 50% within 9 months and achieve a rate of 0.0/1,000 ventilator days by December 31, 2013
- Decrease the rate of VAP by implementing all elements of the ventilator bundle to more than 95% of ventilator patients in the ICU by December 31, 2013

Elevate Head of Bed raised between 30-45 degrees

Keeping the head of the bed between 30 to 45 degrees is a simple nursing measure that has been correlated in VAP reduction. Keeping the head of the bed (HOB) elevated has been demonstrated to help prevent aspiration of gastric contents and secretions. Keeping the HOB elevated helps prevent aspiration of gastric contents and secretions.2,3,4,5.

- Process Measure: Daily audit of HOB elevation compliance and documentation of contraindications

Secondary Driver: Use visual cues

Visual cues are important to help remind staff to elevate the HOB. A visual cue can also act as a guide to show staff what 30 to 45 degrees actually is. Staff often underestimates the angle of the HOB. One study found that HOB angle was perceived correctly by 50 to 86% of clinicians.6

Change Ideas: Visual cues for HOB 30 to 45 degrees

Engage unit staff nurses to develop visual cues that work for their environment and work flow. Standardizing the process of care has shown to increase the number of patients who were placed in the semi recumbent position.7 Examples of visual cues:

- Use a line (red tape) on the wall that can only be seen if the bed is below a 30-degree angle.
- Use a string hanging on the side of the bed to show the correct angle.
- Cut a piece of cardboard in the shape of a slice of pizza at the 30-degree angle.8
- Place a red stripe on the bed’s frame that is at 30-degree angle.
- Include the intervention on nursing flow sheets.
- Incorporate into HOB elevation into standardized order set.

Secondary Driver: Identify one person to check for visual cues

The environment of an intensive care unit is a busy and stressful one. Caregivers are confronted with multiple stimuli making demands for attention. Engagement of the entire team, bedside nurse, intensivists, nurse’s aide, respiratory therapist, and charge nurse, is essential to ensure preventive measures are adhered to such as elevated HOB.
Change Ideas: Include HOB elevation in rounding
- Assign respiratory therapy staff or unit assistant to look for visual cues every one to two hours.
- If computerized, use a pop-up reminder that is computer based.
- Include the intervention on nursing flow sheets.
- Include HOB elevation in charge nurse rounds; charge nurse can provide just-in-time training, if charge nurses are utilized.
- Create an environment where respiratory therapists work collaboratively with nursing to maintain head-of-the-bed elevation.
- If HOB elevation is contraindicated, document rationale.

Secondary Driver: Include cues/reminders on order sets
Previous research and experience suggests that standardized order sets can be effective in improving compliance to evidenced based practice such as ventilator bundles for VAP reduction, improved stroke care, sepsis, and more. Standardized order sets have been shown to increase patient safety and improve outcomes in multiple patient conditions. 9,10,11,12

Change Ideas: Utilize reminders
- If computerized, use a pop-up reminder that is computer based.
- Discuss during multidisciplinary rounds to ensure all bundle components have been implemented.
- Allow physicians to “opt-out” of the bundle or any particular element if contraindicated. Ask physician to help improve bundle by documenting rationale when it is not appropriate for the patient.

Secondary Driver: Educate patients and their families
Families can be made part of care. Education of families about the risks of VAP and how care givers mitigate that risk can help to make the family feel involved and connected. Families can also be asked to participate in that care by helping to keep the HOB 30 to 45 degrees. Families can do this by reminding staff to put the HOB up after such things as linen changes. Consumer groups are encouraging patients’ families to be involved to help keep their loved ones safe. 13

“Hardwiring” HOB elevation as part of improvement plan:
Many of the interventions are not only implementation strategies but also hardwiring strategies. Hardwiring for HOB includes routine reminders such as the following will help the intervention to become part of daily care:
- Include HOB elevation on daily audit checklist.
- Include the intervention on nursing and respiratory care flow sheets.
- Incorporate into HOB elevation into standardized order set.
- If computerized, use a pop-up reminder that is computer based.
- Include HOB elevation in charge nurse rounds. Charge nurse can provide just in time training, if charge nurses are utilized.
- Create an environment where respiratory therapists work collaboratively with nursing to maintain head-of-the-bed elevation.

Peptic ulcer disease (PUD) prophylaxis
Critically ill patients requiring mechanical ventilation are at increased risk for stress ulcers and gastrointestinal bleeding from the stress ulcers. 14 Also, bacterial colonization of the stomach can lead to respiratory tract colonization and infection through aspiration of stomach secretions. 15
- Process Measure: Daily audit of PUD prophylaxis compliance or documented contraindications

Secondary Driver: Use of Medications
To reduce PUD risk, mechanically ventilated patients should receive PUD prophylaxis. 16
**Change Ideas: H2 Blockers**
- H2 blockers are preferred over sucralfate. Proton pump inhibitors may be efficacious and an alternative to sucralfate or H2 antagonist.\(^{17}\)
- Discuss during multidisciplinary rounds.
- Include clinical pharmacist to guide complex cases.

**Secondary Driver: Include PUD on the ICU order sets**
Requiring PUD prophylaxis on both ICU admission and ventilator order sets will standardize the treatment. Allow physicians to “opt-out” when clinically appropriate and document reason for broad learning. You will need to determine how often a physician “opts out” if there are any patterns (certain types of patients, specific physicians) to determine if a change to the order set is required or another intervention is required.

**Secondary Driver: Engage pharmacy (redundancy, failure remediation)**
Asking pharmacy to support your program will add a layer of redundancy and ways to detect failure patterns earlier. They can produce reports from the pharmacy information system and consult with physicians as appropriate. A pharmacist as part of interdisciplinary rounds is beneficial to safety and cost-effective.

**Change Ideas: Multidisciplinary approach**
- Discuss during multidisciplinary rounds.
- Consider producing pharmacy exception report for PUD prophylaxis.
- Include a pharmacist on ICU multidisciplinary rounds.

**Secondary Driver: Include PUD Rx on daily checklist**

**Change Ideas: Make it a part of daily rounds**
- Include PUD in charge nurse rounds. Charge nurse can provide just in time training and assist bedside nurse in obtaining order for PUD, if charge nurses are utilized.

**“Hardwiring” PUD Prophylaxis as part of improvement plan**
To hardwire PUD prophylaxis, make the process of ordering PUD prophylactic mediation routine as possible. If contraindicated then the rationale should be documented. Methods for hardwiring stated above include:
- Include PUD in order sets.
- Include on daily audit checklist.
- Review need for PUD prophylaxis during multidisciplinary rounds.
- Include as a standing item in nurse to nurse handoff reports.

**Venous Thromboembolism (VTE) prophylaxis**
Mechanically ventilated patients are at high risk for VTE. Risk factors include stress inflammatory response resulting in hypercoagulation and immobility. Although there is no evidence to suggest VTE prophylaxis reduces VAP risk, it is appropriate to include in a bundle that supports care of the mechanically ventilated patient due to their high risk for VTE.\(^{18}\)
- Process Measure: Daily audit of VTE prophylaxis compliance or documentation of contraindications

**Secondary Driver: Initiate VTE prophylaxis unless contraindiacted**
All high risk patients should have pharmacological prophylaxis unless contraindiacted due to bleeding risk. For patients with severe bleeding risk, mechanical prophylaxis is recommended unless contraindiacted due to patient condition. Intermittent pneumatic compression (IPC) is preferred for mechanical prophylaxis.\(^{19}\) The addition to pharmacological prophylaxis has shown some benefit in VTE reduction.\(^{20}\)
Change Ideas: Standardize with ICU Order Sets
- Include VTE prophylaxis as part of your ICU order admission set and ventilator order set.
- Allow physicians to “opt out” for appropriate patients and document the reason for learning purposes.

Secondary Driver: Interdisciplinary support
Engage pharmacists to ensure ICU patients have some form of VTE prophylaxis (redundancy, failure remediation); review on interdisciplinary rounds.

Change Ideas: Team approach
- Include VTE in ICU rounds. Nurse leaders can provide just-in-time training and assist bedside nurse in obtaining order for VTE prophylaxis, if charge nurses are utilized.
- Consider creation of a pharmacy exception report to determine if appropriate VTE prophylaxis is provided.

Secondary Driver: Include VTE Rx on daily checklist
“Hardwiring” VTE Prophylaxis as part of improvement plan
Hardwiring VTE prophylaxis strategies are similar to PUD prophylaxis. Making the process as routine as possible will help to ensure that VTE prevention is addressed in every mechanically ventilated patient.
- Include VTE prophylaxis as part of your ICU order admission set and ventilator order set.
- Include on daily audit checklist.
- Include in multidisciplinary rounds.
- Utilize pharmacy to review all patients or produce exception reports to ensure adequate and appropriate prophylaxis.
- Include as a standing item in nurse-to-nurse handoff reports.

Spontaneous Awakening Trials (SAT, or sedation vacation)/ Spontaneous Breathing Trials (SBT)
Sedation in the mechanically ventilated patient may be necessary to control anxiety, help in pain management and control oxygenation demands. However, use of sedation does have disadvantages such as prolonging the duration of mechanical ventilation. It is vital that patients receiving sedation have a neurological assessment daily. Each day the patient’s sedation is withheld until the patient is able to follow commands or he/she becomes agitated. Daily screening of respiratory function using trials of spontaneous breathing with daily awakening trials has been shown to reduce the duration of mechanical ventilation and risk of VAP.21,22,23
- Process Measure: Daily audit of SBT/SAT compliance or documentation of contraindications

Secondary Driver: Spontaneous Awakening Trials (SAT) and a Spontaneous Breathing Trial (SBT) Protocols
The use of non-physician staff driven protocols have been found to be very effective in assessing readiness to wean. By developing staff driven protocols and incorporating SAT and SBT into daily care of the ventilator patient, patients will experience fewer days on the ventilator and a shorter ICU stay.24,25 Staff driven protocols have also demonstrated a reduction in VAP.26

Change Ideas: Assess Daily for Readiness and Success with SAT/SBT
- Determine if patient meets SAT criteria (no contraindications).
- Decrease or stop sedation per SAT protocol (usually nursing).
- Determine if patient meets SBT criteria (no contraindications).
- Perform an SBT per protocol (usually respiratory therapy).
- Perform daily assessments of readiness to wean and extubate based on the SAT/SBT results.
Secondary Driver: Coordinate SAT and SBT to maximize weaning opportunities when patient sedation is minimal

Nursing and respiratory therapy must work as a team to ensure patient safety and that all VAP prevention bundle interventions are addressed. SBTs will fail if the patient has too much sedation to allow for the “spontaneous” portion of the trial.

**Change Ideas: Coordinate and communicate**

- ✓ Provide a daily reduction or removal of sedative support.
- ✓ Consider one time of day that the SAT and SBT are attempted.
- ✓ Determine how often SBTs fail due to high levels of sedation.
- ✓ Coordinate between nursing and respiratory therapy on managing SAT and SBT. Use white boards, EMR or other communication tools to enhance verbal coordination.
- ✓ Discuss the results of SAT and SBT during daily multidisciplinary rounds.
- ✓ SAT and SBT should be included in nurse-to-nurse handoffs, nurse to charge nurse report, and charge nurse to charge nurse report.

Secondary Driver: Sedation should be goal oriented

Sedation is often needed to assist in the pulmonary recovery of patient. Too little sedation can lead to increased anxiety, increased work of breathing, drop in blood and tissue oxygenation and self extubation. Too much sedation can lead to decreased respiratory muscle function, prolonged neurological depression and the inability to wean from mechanical ventilation. The use of a sedation algorithm or scale, such as the RASS, that all caregivers use to monitor the level of sedation will help to reduce over sedation, help to deliver the most effective dose, and reduce mechanical ventilation time.²⁷,²⁸

**Change Ideas: Implement a sedation protocol**

- ✓ Administer sedation using goal according to a scale such as a RASS, SAS or Modified Ramsey Score as ordered by MD. These scores also help standardize communication and actually take less time than varying qualitative descriptions of level of sedation.
- ✓ Assess at least daily if the target RASS/Modified Ramsey/SAS goal is met or reasons why it is not.
- ✓ Implement ABCDE bundle. “The ABCDE bundle includes spontaneous awakening and breathing trial coordination, careful sedation choice, delirium monitoring, and early progressive mobility and exercise. The intent of combining and coordinating these individual strategies is to (1) improve collaboration among clinical team members, (2) standardize care processes, and (3) break the cycle of over sedation and prolonged ventilation, which appear causative to delirium and weakness.”²⁹,³⁰
  - o A & B = awakening and breathing trial coordination
  - o C = Choice of sedative
  - o D = Delirium detection
  - o E = Early progressive mobility and exercise ³¹,³²

“Hardwiring” SBT & SAT as part of improvement plan

To hardwire SBT/SAT, incorporate intervention in daily work flow. Examples of hardwiring include:

- ✓ Implement non-physician staff driven protocols for daily SBT/SAT.
- ✓ Include SBT & SAT protocol on order sets.
- ✓ Include in daily audit checklist.
- ✓ Include on nursing and respiratory care flow sheets.
- ✓ Include as a standing item in nurse-to-nurse handoff reports.
- ✓ Anticipate fears about self-extubation and manage implementation in smaller steps. The literature suggests self-extubation is slightly higher but re-intubation is not, indicating that many if not most patients were ready for extubation.
Oral Care

Oral care can seem like a simple thing but often the ‘simple’ things are the hardest to implement. A nurse swabbing a patient’s mouth with an antiseptic mouthwash has been, until recently, associated mostly with comfort. Recent studies have demonstrated that oral care with an antiseptic has reduced the risk for VAP.

- **Process Measure:** Daily audit of oral care compliance

**Secondary Driver:** Perform regular oral care with an antiseptic solution, brush teeth, and perform oral and pharyngeal suctioning

It is a simple thing that can have a large impact in protecting a patient from VAP.  

**Change Ideas: Routine Oral Care Standardized**

- Teeth brushing twice a day as part of order sets for all ventilated patients.  
- Include routine (every two-four hours) oral care with antiseptic mouthwash swab to clean oral cavity and teeth.  
- Chlorhexidine 0.12% mouthwash at least daily (many studies cite every 12 hours) as part of order sets for all ventilated patients.  
- Create visual cues (e.g., empty holders of oral care products; dating and timing products) indicating compliance with oral care.  
- Include respiratory therapy in performing oral care; make it a joint RN and RT function.  
- Use white board to document delivery of oral care thus making failure ‘obvious.’

**Secondary Driver:** Educate the RN staff about the rationale supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia

Institution of the ventilator bundle alone does not always result in a decrease in VAP. A decrease in VAP is more likely to occur when compliance with the “bundle” is audited and feedback is given to the staff on a routine basis.

**“Hardwiring” Oral Care as part of improvement plan**

Like the earlier interventions, hardwiring oral care is multifocal.

- Include oral care in order sets.  
- Include on nursing care flow sheets.  
- Make it obvious that oral care has been provided.  
- Involve family if appropriate.

**Potential Barriers:**

- Clinicians may believe, strongly so, that they already perform these activities, especially if the VAP rate is low. Monitor for bundle compliance to test the reliability of each of the primary drivers in practice. For example, check five ventilated patients to determine bundle compliance on each element. Was the sedative really turned off and for how long? Was it restarted at the same dose or was it lowered if possible. If IPC was used for VTE prophylaxis, was it actually functioning? Is there documentation of medications for PUD and VTE prophylaxis if appropriate?  
- Recognize that for many physicians this will change their practice.
  - Traditionally, weaning and sedation was a function of the physician, not an interdependent function with non-physician staff. Include lead physicians in the improvement team. Select these leads to work as champions to dialogue with physician colleagues.  
  - Order sets and protocols seen by some physicians as “cookbook” medicine. It is actually “best recipe” medicine that uses what is known in the literature to provide the best opportunity for each patient based on their individual needs to receive the care that will reduce their risk for VAP.  
  - Clinicians may see tasks as “ours” and “theirs,” such as: oral care is perceived as a nursing task,
medications are the responsibility of the physician or ventilators are the responsibility of the respiratory therapist. Including key stakeholders such as bedside nurses, physicians, and respiratory therapists in the improvement team to develop protocols, work flows, conduct peer to peer education has been shown to be effective in successfully implementing best practices.\textsuperscript{42,43} 

- These processes may be new territory for many physicians, nurses, respiratory therapists, and pharmacists. Nurses and respiratory therapists may be concerned that they may make a mistake, that patients may self extubate during a SBT/SAT trial, or that the medical staff will not be receptive and may become angry. Education of all parties, both about the risk of VAP and proven methodologies to reduce VAP, and evidence from like hospitals demonstrating successful implementation without the dangers of self extubation or other preconceived complications will help mitigate this.

**Using administrative leadership sponsorship to help remove or mitigate barriers**

- It is important to start with the one early adopter physician who can help lead and then recruit early adopter champions from specialties and intensivists.
- A management executive sponsor, recognizing the value to the patients and the value to the organization of preventing VAP, can help brainstorm solutions to what may appear to be added work, or provide resources to mitigate that additional work. An executive sponsor can also help to see the “big picture” on how this may impact organization-wide, and champion through requests for workflow change or supplies. Executive sponsors can help educate, lead, and provide solutions to staffing barriers.
- A senior or “opinion leader” physician is crucial to accomplish the goal of organization-wide adoption of best practices order sets. The unit that you decide to first trial this change should be in an area where the initiative is supported by a respected physician leader.

**Not just a change in practice but a change in culture**

- Instituting the VAP bundle well require a change in culture, particularly physician culture. The physicians will be asked to trade their traditional way of individualizing mechanical ventilation management for each patient for a more standardized and effective approach. This may appear to be both a loss of control as well as irresponsible to give up that control. Yet, physicians remain key components on monitoring the effectiveness of therapy and the overall condition of the patient.
- Nurses and respiratory therapists will also experience change in that this may be the first time they would have to collaborate to such a degree. Many may be uncomfortable with the notion of staff driven protocol independent of the physicians. Education and involvement of staff in the development of the protocols may help to mitigate.
- Order sets feel like a loss of autonomy to clinicians who are not used to them. For some, this will be a change in how they work. Take advantage that many physicians learn from peers. Most physicians will follow their peers before they will follow “expert advice.”
- This is an example of an innovation that will require small tests of changes and planned spread driven by success. The ideal end result is the development of team based care where each member of the team (physician, nurse, respiratory therapist) contributes to better and safer patient care.

**Tips on How to Use the Model for Improvement**

- Implementing the VAP Bundle – take it an element at a time.
  - When deciding what of the bundle to first implement, choose a bundle element that would be easy to try and will have a great impact. For example, implementing HOB elevation is less complicated and has a big impact on VAP risk reduction compared to implementing a complicated SBT/SAT protocol.
Testing SBT/SAT protocols

- Step One: Plan –
  - Do not reinvent the wheel when developing SBT/SAT/Delirium protocol. Use another hospital’s protocol that has been successful and adapt it to your facility.
  - Take it one step at a time. Do not plan to implement all of the ABCDE recommendations. Concentrate first on the ABC and then add the D and E.

- Step Two: Do –
  - Ask one or two of the physicians on the committee to trial this with their next ventilated patients. This should be someone who wants to work with you.
  - Ask one or two nurses and a respiratory therapist to trial the protocol on the committee that is comfortable.
  - Test small: Coordinate with the physician to use the protocol on one patient, with one nurse, and one respiratory therapist.

- Step Three: Study –
  - Evaluate immediately after the test with those involved in the test to record what did happen, what went well, what did not go well, and what should we change for next time? Make the posttest huddles short and action oriented.

- Step Four: Act –
  - Do not wait for the next committee meeting to make the changes.
  - Next test use the same physician, same nurse, same respiratory therapist.
APPENDIX I: Example of VAP Bundle Visual Cue – Posted at the Bedside

ICU BEST PRACTICE
for
VENTILATED PATIENTS

H  ead of bed up 30 – 45 degrees
E  nteral feeding and q 2 hour oral care
A  ir mattress and turn q 2 hour
D  VT prophylaxis
S  edation vacation

U  lcer prophylaxis
P  ain control
APPENDIX II: ABDCE Protocol Example from ICU delirium.org

Bedside Treatments for ABCDE Protocol www.ICUdelirium.org

Awakening and Breathing Coordination

ABC

**Eligibility for ABC = on the ventilator**

**SAT Safety Screen:** No active seizures, no active alcohol withdrawal, no active agitation, no active paralytics, no active myocardial ischemia, no evidence of ↑ intracranial pressure

**If passed the safety screen, Perform SAT**
(Stop all sedatives/analgesics used for sedation)

**If fail → restart sedatives if necessary at ½ dose and titrate as needed**

**If pass → Perform SBT safety screen**

**SBT Safety Screen:** No active agitation, oxygen saturation > 88%, FiO₂ < 50%, PEEP < 7.5 cm H₂O, no active myocardial ischemia, no significant vasopressor use, displays any inspiratory efforts

**If passed the safety screen, Perform SBT**
SBT is discontinuation of active ventilator support through a T-tube or ventilator with a rate set as 0, CPAP/PEEP ≤ 5 cmH₂O, and pressure support of ≤ 5 cmH₂O.

**If fail → Return to ventilator support at previous settings**

**If pass → Team should consider extubation**

D

Delirium Nonpharmacologic Interventions

**Eligibility for D = RASS > -3 (any movement or eye opening to voice)**

**Pain:** Monitor and/or manage pain using an objective scale

**Orientation:** Talk about day, date, place; discuss current events; update white boards with caregiver names; use clock and calendar in room

**Sensory:** Determine need for hearing aids and/or eye glasses

**Sleep:** Provide & encourage sleep preservation techniques like noise reduction, day-night variation, “time-out” to minimize interruptions of sleep, promoting comfort & relaxation

E

Early Exercise and Mobility

**Eligibility for E = All MIND-USA study patients**

**Exercise Safety Screen:** RASS > -3, FiO₂ <0.6, PEEP <10 cm H₂O, no increase in vasopressor dose (2 hrs.), no active myocardial ischemia (24 hrs.), and no arrhythmia requiring the administration of a new antiarrhythmic agent (24hrs)

**Levels of Therapy** (if passes safety screen):

1. Active range of motion exercises in bed and sitting position in bed
2. Dangling
3. Transfer to chair (active), includes standing without marching in place
4. Ambulation (marching in place, walking in room/hall)

These activities will be actively monitored as part of the MIND-USA study with the goal for bedside staff to perform with study patients by 2 pm daily.
References

10 Abbot CA, Dremsa T, Stewart DW, Mark DD, Swift CC. Adoption of a ventilator-associated pneumonia clinical practice guideline. Worldviews on Evidence-Based Nursing. 2006;4(3)139-152.