VENTILATOR ASSOCIATED PNEUMONIA (VAP)/
VENTILATOR ASSOCIATED EVENTS (VAE) CHANGE PACKAGE

Preventing Harm from VAP/VAE
The AHA/HRET HEN would like to acknowledge our partner, Cynosure Health, for their work in developing the Ventilator Associated Pneumonia (VAP)/Ventilator Associated Events (VAE) Change Package.
OVERVIEW

Background
• Patients on mechanical ventilation are at high risk for Ventilator Associated Pneumonia (VAP), with attributable mortality rates up to 40%.
• VAP is the leading cause of death among hospital-acquired infections, exceeding the death rate due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient.
• VAP also prolongs time spent on the ventilator, the length of ICU stay, and the length of hospital stay after discharge from the ICU.
• For 2010, NHSN facilities reported more than 3,525 VAPs; 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 median state 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)

IDEAS TO TEST
• Use visual cues that make it easy to identify when the bed is in the proper position, e.g. a line on the wall that can only be seen if the bed is below a 30-degree angle.
• Include clues on order sets for the initiation of and weaning from mechanical ventilation, for delivery of tube feedings, and for provision of oral care.
• Create an environment in which respiratory therapists work collaboratively with nurses to maintain head-of-the-bed elevation.

• Use medications: H2 blockers are preferred over sucralfate, and proton-pump inhibitors may be efficacious and an alternative to sucralfate or an H2 antagonist.
• Include PUD prophylaxis on the ICU admission and ventilator order sets.
• Incorporate review of PUD prophylaxis into daily multi-disciplinary rounds.
• Engage pharmacy in daily multi-disciplinary rounds to ensure ICU patients are given appropriate PUD and VTE prophylaxis.

• Initiate VTE prophylaxis on all mechanically-ventilated patients unless contraindicated.
• Include VTE prophylaxis as part of the ICU admission and ventilator order sets.

• Develop protocols, order sets, and standard work for Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT), Delirium, Sedation, and Early Progressive Mobility.
• Perform daily assessments of readiness to wean and extubate.
• Create an environment in which respiratory therapists work collaboratively with nurses to facilitate a daily “sedative interruption” and potential “weaning trial.”
• Implement a protocol to lighten sedation daily to assess for readiness for extubation. Include precautions to prevent self-extubation such as increased monitoring during the trial.

• Perform regular oral care with an antiseptic solution, e.g. Chlorhexidine, in accordance with the manufacturer’s product guidelines.
• Include daily oral care with Chlorhexidine as part of the ICU admission and ventilator order sets.
• Educate the RN staff about the rationale for supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia.

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. Retrieved at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00045365.htm
• Society of Hospital Medicine Guidelines for Preventing VAP. Retrieved at: http://www.hospitalmedicine.org/AM
• IDSA and SHEA Compendium on VAP. Retrieved at: http://www.jstor.org/stable/10.1086/591062
• IHI How to Guide Preventing VAP. Retrieved at: http://www.ihi.org/knowledge/Pages/Tools
**AIM:** Decrease the rate of VAP to a median state of 0.0/1,000 ventilator days for at least 6 months by December 31, 2013.

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| **Elevate the Head of the Bed to between 30-45 degrees** | • Use visual cues so that it is easy to identify when the bed is in the proper position.  
• Designate one person to check for visual cues every 1-2 hours in the entire unit.  
• Include the cues on the order sets for initiation of and weaning from mechanical ventilation, for delivery of tube feedings, and for 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.  
• Assign respiratory therapy staff or a unit assistant to check visual cues every 1-2 hours.  
• If using an electronic practice management system, institute computer-based pop-up reminders.  
• Include the intervention on nursing flowsheets.  
• Discuss during multi-disciplinary rounds.  
• Include HOB elevation in charge nurse rounds; charge nurse can provide just-in-time training. |
| **Peptic ulcer disease (PUD) prophylaxis** | • Use appropriate medications.  
• Include PUD on the ICU admission and ventilator order sets.  
• Engage pharmacy to ensure ICU patients have appropriate 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 an H2 antagonist.  
• Discuss PUD prophylaxis during multi-disciplinary rounds.  
• Include PUD prophylaxis in charge nurse rounds; the charge nurse can provide just-in-time training and assist bedside nurses in obtaining orders for PUD prophylaxis. |
| **Venous Thromboembolism (VTE) prophylaxis** | • Initiate VTE prophylaxis unless contraindicated.  
• Engage the pharmacy to ensure ICU patients are given appropriate VTE prophylaxis (redundancy, failure remediation).  
• Include VTE prophylaxis on daily checklist. | • Include VTE prophylaxis as part of your ICU admission and ventilator order sets.  
• Include VTE prophylaxis in all ICU rounds; nurse leaders can provide just-in-time training and assist bedside nurses in obtaining orders for VTE prophylaxis. |
| **ABCDE Bundle** | • “A & B” – Develop protocols, order sets, and standard work procedures for Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT).  
• “C” - Coordinate SAT and SBT to maximize weaning opportunities when patient sedation is minimal.  
• “D” - Sedation should be goal-oriented.  
• “E” - Early progressive mobilization and ambulation. | • Perform daily assessments of readiness to wean and extubate.  
• Provide a daily reduction or removal of sedative support.  
• Designate one time of the day for the SAT and SBT to be attempted.  
• Coordinate between nursing and respiratory therapy to manage SAT and SBT. Use whiteboards, the EMR or other communication tools to enhance coordination.  
• Discuss the results of the SAT and SBT during daily multi-disciplinary rounds.  
• The SAT and SBT should be included in nurse-to-nurse handoffs, nurse-to-charge nurse reports, and charge nurse-to-charge nurse reports (if they occur).  
• Administer sedation as ordered by the physician according to a scale such as a RASS\(^1\) or Modified Ramsay Score.  
• Modify ICU orders to default activity level to “as tolerated.”  
• Implement an early progressive mobility protocol. |
### PRIMARY DRIVERS | SECONDARY DRIVERS | CHANGE IDEAS
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**Oral Care** | • Perform regular oral care with an antiseptic solution, brush teeth, and perform oral and pharyngeal suctioning.  
• Educate the RN staff about the rationale supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia. | • Include teeth brushing twice a day in order sets for all ventilated patients.  
• Include routine oral care every 2-4 hours with an antiseptic mouthwash swab to clean the oral cavity and teeth.  
• Use 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) to indicate compliance with oral care.  
• Include Respiratory Therapy in performing oral care, make it a joint RN and RT function.

### FOOTNOTES

1 Richmond Agitation Sedation Scale (RASS)  
PREVENTION OF VENTILATOR-ASSOCIATED PNEUMONIA (VAP)

Mechanically ventilated patients are at high risk for complications such as ventilator-associated pneumonia (VAP), peptic ulcer disease (PUD), gastrointestinal bleeding, aspiration, venous thromboembolic events (VTE), and problems with secretion management. Evidence-based interventions can reduce the risk and incidence of these complications. For example, implementation of the ventilator bundle has been shown to reduce VAP.\(^1\)

The VAP prevention bundle includes: head of bed elevation to 30 to 45 degrees, oral care with Chlorhexidine 0.12%, peptic ulcer prophylaxis, deep vein thrombosis (DVT) prophylaxis, and spontaneous awakening trials and breathing trials. This guide presents evidence-based practices to promote VAP reduction.

Ventilator-Associated Events (VAE) Surveillance

Ventilator-associated pneumonia has been problematic to identify because commonly used definitions for VAP include subjective criteria that are neither sensitive nor specific for VAP. The previous surveillance definition included: a combination of x-ray, signs/symptoms and laboratory criteria. Three specific sets of PNEU criteria are available for a PNEU to be counted as a VAP: the endotracheal tube (ETT)/ventilator must have been in place (1) at some time during the preceding 48 hours or (2) at the time of the PNEU onset; and (3) there was no required amount of time that the ETT/ventilator must have been in place. Major limitations of the former VAP definitions are:

• these VAP definitions rely on complex multiple and sometimes subjective pathways;
• no valid, reliable definition for VAP exists;
• the criteria that do exist are neither sensitive nor specific; and
• they require radiographic findings of pneumonia whereas evidence-based research suggests chest radiographic findings are not diagnostic for VAP.

These limitations have implications for prevention.

In January 2013, the Centers for Disease Control (CDC) released a new approach to surveillance for Ventilator-Associated Events (VAE) for the National Healthcare Safety Network (NHSN). Surveillance has been limited to Ventilator-Associated Pneumonia to date. This new VAE Surveillance was designed to address the limitations of the former VAP definitions including the NHSN PNEU.

The new VAE surveillance definition algorithm has been founded on objective, streamlined, and potentially automatable criteria. It is designed to objectively identify a broad range of conditions and complications that may occur in mechanically-ventilated patients.

### VAE ALGORITHM

<table>
<thead>
<tr>
<th>Patient on mechanical ventilation &gt; 2 days</th>
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<tr>
<td>Baseline period of stability or improvement, followed by sustained period of worsening oxygenation</td>
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<tr>
<td>Ventilator-Associated Condition (VAC)</td>
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<tr>
<td>General, objective evidence of infection/inflammation</td>
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<tr>
<td>Infection-Related Ventilator-Associated Complication (IVAC)</td>
</tr>
<tr>
<td>Positive results of laboratory/microbiological testing</td>
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<tr>
<td>Possible or Probable VAP</td>
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NOTE: The VAE algorithm is for use in surveillance, not as a clinical definition algorithm and is not intended for use in the clinical management of patients. The VAE algorithm is only applicable to mechanically-ventilated patients > 18 years of age.

There are three definitions/tiers in the VAE algorithm:

1. Ventilator-Associated Condition (VAC);
2. Infection-Related Ventilator-Associated Complication (IVAC); and
3. Possible and Probable VAP.

This algorithm takes into account research that to date has suggested that most VACs are due to pneumonia, ARDS, atelectasis, and pulmonary edema. These significant clinical conditions may be preventable. The definition of VAE states: “VAEs are identified by using a combination of objective criteria: deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection.” The full document can be retrieved at: http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf

**SUGGESTED AIDS**

An AIM statement for VAP reduction efforts could include one of the following:

• Decrease the rate of VAP to a median state of 0.0/1,000 ventilator days (or mean state <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 for more than 95% of ventilator patients in the ICU by December 31, 2013.

**ELEVATE THE HEAD OF THE BED TO BETWEEN 30-45 DEGREES**

Angling the head of the bed to between 30 to 45 degrees is a simple nursing measure that has resulted in VAP reduction. Keeping the head of the bed (HOB) elevated has been shown to help prevent aspiration of gastric contents and secretions. Angling the head of the bed to between 30 to 45 degrees is a simple nursing measure that has resulted in VAP reduction. Keeping the head of the bed (HOB) elevated has been shown to help prevent aspiration of gastric contents and secretions. 

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

**Secondary Driver: Use visual cues.**

Visual cues are important to remind staff to elevate the HOB. A visual cue can also act as a guide to show staff how steep 30 to 45 degrees should be; staff often underestimate the angle of the HOB. One research study found that HOB angle was perceived correctly by only 50 to 86% of clinicians.

**Change Ideas: Visual cues for HOB elevation to 30 to 45 degrees**

Engage staff nurses to develop visual cues that work for their environment and work flow (See Appendix I for an example of a VAP Bundle Visual Cue). Standardizing the process of care has been shown to increase the number of patients who are placed in a semi-recumbent position. Examples of visual cues include:

- Using a line (red tape) on the wall that can only be seen if the bed is below a 30-degree angle.
- Cutting a piece of cardboard in the shape of a slice of pizza, i.e. a 30 degree triangle.
- Placing a red stripe on the bedframe at a 30 degree angle. When the HOB is at 30 degrees, the red stripe will appear to be parallel to the floor (See Appendix II for an example of a Red Stripe on Bed Frame).
- Including the interventions on nursing flowsheets.
- Incorporating HOB elevation into the 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, including bedside nurses, intensivists, nurse’s aides, respiratory therapists, and the charge nurse, is essential to ensure preventive measures such as elevated HOB are adhered to. (See Appendix III for an example of a Best Practices Checklist).

**Change Ideas: Include HOB elevation in rounding**

- Assign respiratory therapy staff or a unit assistant to look out for visual cues every 1-2 hours.
- If using an electronic practice management system, institute computer-based pop-up reminders.
- Include interventions on nursing flowsheets.
- Include HOB elevation in charge nurse rounds, if performed; the charge nurse can provide just-in-time training as needed.
- Promote an environment in which respiratory therapists work collaboratively with nursing staff to maintain head-of-the-bed elevation.
- If HOB elevation is contraindicated, communicate and document the rationale.

**Secondary Driver: Include cues/reminders on order sets**

Research suggests that standardized order sets can be effective in improving compliance with evidence-based practices such as ventilator bundles for VAP reduction, improved stroke care, and sepsis. Standardized order sets have been shown to increase patient safety and improve outcomes for multiple patient conditions.

**Change Ideas: Utilize reminders**

- If using an electronic practice management system, institute computer-based pop-up reminders.
- Discuss procedures during multi-disciplinary rounds to ensure that all of the bundle components have been implemented.
- Allow physicians to “opt-out” if the bundle or one of its elements is contraindicated. Ask the physician to help improve bundle by communicating and documenting the rationale for why the intervention is not appropriate for the patient.

**Secondary Driver: Educate patients and their families**

Families can be invited to participate in care. Education of families about the risks of VAP and how caregivers can mitigate those risks allow the family to feel involved and connected. Families can also be asked to help keep the HOB elevated to 30 to 45 degrees, by, for example, reminding staff to elevate the HOB after linen changes. Consumer groups are also encouraging patient’s families to partner with hospital staff to keep their loved ones safe.
“Hardwiring” HOB Elevation in Improvement Plans
Hardwiring for HOB includes routine reminders to help the intervention to become part of daily care, such as:
• Including HOB elevation on the daily audit checklist.
• Including the intervention on nursing and respiratory care flowsheets.
• Incorporating HOB elevation into standardized order sets.
• If using an electronic practice management system, instituting computer-based pop-up reminders.
• Including HOB elevation in charge nurse rounds, so charge nurse can provide just-in-time training.
• Promoting an environment where respiratory therapists work collaboratively with nursing staff to maintain HOB elevation.

PEPTIC ULCER DISEASE (PUD) PROPHYLAXIS
Critically ill patients requiring mechanical ventilation are at increased risk for stress ulcers and subsequent gastrointestinal bleeding. Additionally, bacterial colonization of the stomach can lead to infection of the respiratory tract through aspiration of stomach secretions.16

• 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.17

Change Ideas: H2 Blockers
• H2 blockers are preferred over sucralfate. Proton-pump inhibitors (PPI) may be efficacious, and serve as an alternative to sucralfate or an H2 antagonist.18
• Discuss interventions during multi-disciplinary rounds.
• Include a clinical pharmacist on the care team 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. However, allow physicians to “opt-out” when clinically appropriate, and ask them to communicate and document the reasons for the “opt-out” to promote learning and understanding among the healthcare team. Audit how frequently physicians “opt-out” to observe if there are any patterns (e.g. certain types of patients, specific physicians) that might suggest that a change to the order set or another intervention is necessary.

Secondary Driver: Engage pharmacy (redundancy, failure remediation).
Asking the pharmacy to support your program will add a layer of redundancy to improve reliability and promote opportunities for earlier detection of failure patterns. A pharmacist as part of interdisciplinary rounds is cost-effective and can improve safety. Pharmacists can produce reports from the Pharmacy Information System that can positively affect care and can consult with physicians as medically appropriate.

Change Ideas: Multidisciplinary approach
• Discuss procedures and interventions during multidisciplinary rounds
• Consider producing a 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 prophylaxis in charge nurse rounds, if charge nurses are utilized. A charge nurse can provide just-in-time training and assist bedside nurses in obtaining orders for PUD prophylaxis.

“Hardwiring” PUD Prophylaxis into the Improvement Plan
To hardwire PUD prophylaxis, make the process of ordering PUD prophylactic medications as routine as possible. If such orders are contraindicated, then the rationale should be communicated and documented. Methods for hardwiring include:
• Including PUD prophylaxis in order sets.
• Including PUD prophylaxis on the daily audit checklist.
• Reviewing the need for PUD prophylaxis during multi-disciplinary rounds.
• Including as a standing item in nurse-to-nurse hand-off reports.

VENOUS THROMBOEMBOLISM (VTE) PROPHYLAXIS
Mechanically-ventilated patients are at high risk for VTE. Risk factors include immobility and a stress inflammatory response resulting in hypercoagulation. Although there is no evidence to suggest VTE prophylaxis reduces VAP risk, it is appropriate to include VTE prophylaxis in a bundle that promotes improved care of mechanically-ventilated patients due to their high risk for VTE.19

• Process Measure: Daily audit of VTE prophylaxis compliance or documentation of contraindications.
**Secondary Driver: Initiate VTE prophylaxis unless contraindicated.**

All high risk patients should have pharmacological VTE prophylaxis unless it is contraindicated due to bleeding risk. For patients with severe bleeding risk, mechanical prophylaxis is recommended unless contraindicated due to the patient's condition. Intermittent pneumatic compression (IPC) is preferred for mechanical prophylaxis.\(^{20}\) The addition of mechanical prophylaxis to pharmacological prophylaxis has shown some benefits in VTE reduction.\(^{21}\)

**Change Ideas: Standardize with ICU Order Sets**

- Include VTE prophylaxis in the ICU admission order set and the ventilator order set.
- Allow physicians to “opt-out” with appropriate patients, and ask that the rationale for the “opt-out” be communicated and documented.

**Secondary Driver: Interdisciplinary support.**

Engage pharmacists to ensure ICU patients have been given appropriate VTE prophylaxis and to review pharmacotherapy on interdisciplinary rounds.

**Change Ideas: Team approach**

- Include VTE prophylaxis in ICU rounds; nurse leaders can provide just-in-time training and assist bedside nurses in obtaining orders for VTE prophylaxis.
- Consider creation of a pharmacy exception report to determine if appropriate VTE prophylaxis is being provided.

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

**“Hardwiring” Standardize Interventions for Patients at Risk for Falling in Improvement Plans**

Hardwiring strategies for VTE prophylaxis are similar to those for PUD prophylaxis. Making the process as routine as possible will assure that VTE prevention is addressed for every mechanically-ventilated patient.

- Include VTE prophylaxis in the ICU admission and ventilator order sets.
- Include VTE prophylaxis on the daily audit checklist.
- Include VTE prophylaxis in multi-disciplinary rounds.
- Utilize the pharmacy to review all patients or to produce exception reports to ensure adequate and appropriate prophylaxis.
- Include VTE prophylaxis as a standing item in nurse-to-nurse hand-off reports.

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**THE ABCDE BUNDLE**

The ABCDE Bundle extends the original VAP Bundle and its HOB, PUD prophylaxis, VTE prophylaxis, and oral care interventions. The ABCDE Bundle was developed to improve the health of ventilated patients by reducing their risk of oversedation, immobility, and mental status changes.

The bundle approach provides a means to incorporate evidence-based interventions into patient care. Bundles are not meant to be rigid recipes for the care of ventilated patients; providers should assess which components of a bundle would be appropriate for each individual patient. “The ABDCDE 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.\(^{23,24}\)

**ABCDE Bundle components:**

- A – Awakening trials for ventilated patients
- B – Spontaneous Breathing trials
- C – RN and respiratory therapist Coordination to perform spontaneous breathing trials by reducing or stopping sedation so as to awaken the patient
- D – Standard Delirium assessment program, including treatment and prevention options
- E – Early mobilization and ambulation of critically ill patients.\(^{25,26,27}\)

**Secondary Driver: “A” & “B” — Spontaneous Awakening Trial (SAT) and Spontaneous Breathing Trial (SBT) Protocols.**

Sedation in the mechanically ventilated patient may be necessary to control anxiety, reduce pain, and control oxygenation needs. However, the use of sedation can prolong the duration of mechanical ventilation. Patients receiving sedation should have a neurological assessment daily, in which the patient’s sedation is withheld until the patient is able to follow commands or until the patient becomes agitated. Daily screening of respiratory function using trials of daily awakening and spontaneous breathing has been shown to reduce the duration of mechanical ventilation and the risk of VAP.\(^{28,29,30}\)
**Secondary Driver: “D” — Sedation should be goal oriented.**

Sedation typically assists in the pulmonary recovery of patients. However, too little sedation can lead to increased anxiety, increased work of breathing, a 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, to monitor the level of sedation will help to reduce over-sedation, deliver the most effective dose, and reduce mechanical-ventilation duration. 34,35 (See Appendix VI for a sample Delirium Prevention protocol and Appendix VII for a sample Sedation protocol).

**Change Ideas: Assess Daily for Readiness and Success with SAT/SBT**
- Determine if a patient meets the SAT criteria with no contraindications.
- Decrease or stop sedation per the SAT protocol (nurse).
- Determine if patient meets SBT criteria with no contraindications.
- Perform an SBT per the protocol (respiratory therapist).
- Perform daily assessments of readiness to wean and extubate based on the SAT/SBT results.

**Secondary Driver: “C” — 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 to address the selected VAP prevention bundle interventions. SBTs will fail if the patient has too much sedation to allow for “spontaneous” awakening or breathing.

**Change Ideas: Coordinate and communicate**
- Provide a daily reduction in or removal of sedative support.
- Designate a time of the day that the SAT and SBT will be attempted that allows for periods of patient rest. (See Appendix V for a sample of Communication of Rest Period).
- Determine how often SBTs have failed due to high levels of sedation.
- Coordinate between nursing and respiratory therapy to manage SAT and SBT. Use whiteboards, the EMR, or other communication tools to enhance coordination.
- Discuss the results of a patient’s SAT and SBT during daily multi-disciplinary rounds.
- The SAT and SBT results should be included in nurse-to-nurse hand-offs, nurse-to-charge nurse reports, and charge nurse-to-charge nurse reports.

**Secondary Driver: “E” — Early progressive mobilization and ambulation.**

Many research studies have explored ICU-acquired weakness, the acute onset of neuromuscular/functional impairment in the critically ill for which there is no plausible cause other than critical illness. 36,37,38 This weakness impairs ventilator weaning and functional mobility and can persist well after hospital discharge. Early progressive mobility can mitigate this neuromuscular/functional impairment and reduce the inherent risks of immobility such as VAP, hospital-acquired pneumonia, prolonged length-of-stay, skin breakdown, delirium incidence, and decreased cardiovascular function. 40,41 “Progressive mobility is defined as a series of planned movements in a sequential manner beginning at a patient’s current mobility states/levels with a goal of returning to his/her baseline.” 42 (See Appendix X for a sample Mobility protocol).
**Change Ideas: Early implementation of a progressive mobility protocol**

- Modify standardized ICU admission orders to change the default activity level from “bed rest” to “as tolerated.”
- Establish and disseminate simple guidelines for physical and occupational therapy consultations.
- Incorporate the ABCDE bundle into standing orders as a default order making it a daily part of care; provide “opt-outs” for patients for whom the bundle or its individual elements are contraindicated.

**“Hardwiring” ABCDE as part of improvement plan**

To hardwire SAT/SBT, incorporate the intervention into the daily workflow by:
- Implementing protocols for non-physician staff for daily SAT/SBT.
- Including SAT and SBT protocols on order sets.
- Including SAT and SBT protocols on daily audit checklists.
- Including SAT and SBT protocols on nursing and respiratory care flowsheets.
- Including SAT and SBT protocols as a standing item in nurse-to-nurse hand-off reports.
- Managing protocol implementation in smaller steps and anticipating staff fears about patient self-extubation. Research literature suggests that self-extubation is slightly higher with SAT/SBTs, but re-intubation rate is lower in the SBT/SAT group; indicating that many patients were ready for extubation. 43,44

**ORAL CARE**

Oral care may seem simple, but can be challenging to implement. Swabbing a patient’s mouth with an antiseptic mouthwash has been recommended for comfort, but recent studies have demonstrated that oral care with an antiseptic has also 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.**

Oral care is a basic task that can positively impact VAP prevention. 45

**Change Ideas: Routine Oral Care Standardized**

- Teeth brushing twice a day in order sets for all ventilated patients. 46,47
- Include routine oral care (at least every 2-4 hours) with an antiseptic mouthwash swab to clean the oral cavity and teeth. 48
- Order Chlorhexidine 0.12% mouthwash at least daily (many studies cite every 12 hours) for all ventilated patients. 49,50,51
- Create visual cues (e.g. empty holders of oral care products; by dating and timing products) to demonstrate compliance with oral care.
- Engage Respiratory Therapy in the performance of oral care; make it a joint RN and RT function.
- Use a whiteboard to document the delivery of oral care; omissions make procedure failure obvious.

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

Institution of the ventilator bundle does not by itself guarantee a decrease in VAP. A decrease in VAP is more likely to occur when compliance with the bundle is audited and staff are provided with routine feedback and coaching. 52,53

**“Hardwiring” Oral Care in Improvement Plans**

Multi-focal options for “hardwiring” include:
- Incorporating oral care in order sets.
- Including oral care on nursing care flowsheets.
- Visibly documenting that oral care has been provided.
- Involving the patient’s family, if appropriate.

**POTENTIAL BARRIERS**

- Clinicians may believe that they are complying with these activities, especially if the VAP rate is low, but documentation of bundle compliance is critical to ensure reliability of these interventions. Monitoring to confirm compliance includes:
  - Checking 5 ventilated patients to determine bundle compliance for each element.
  - Was the sedative infusion truly turned off and, if so, for how long?
  - Was the infusion restarted at the same dose or was the dose lowered if possible?
  - If an intermittent pneumatic compression device was used for mechanical VTE prophylaxis, was it actually operating/functioning?
  - Was staff documentation of ordering and administering medications for PUD and VTE prophylaxis appropriate?
• Recognize that many physicians will perceive these interventions as a change in their practice.
  — Traditionally, ventilation weaning and sedation were part of the physician’s role, not inter-dependent functions implemented by non-physician staff. Select respected lead physicians to serve on the improvement team and advocate as champions with physician colleagues to discuss and implement these changes. Order sets and protocols are seen by some physicians as “cookbook” medicine. Reframe these interventions as “best recipe” medicine that uses research findings to suggest improved and individualized patient care options to reduce the risk of VAP.
  — Clinicians may define tasks as “ours” and “theirs.” Examples include: oral care is a nursing task, medications are the responsibility of the physician, and ventilators are managed by the respiratory therapist. Include key stakeholders such as physicians, bedside nurses, and respiratory therapists on improvement teams to collaborate in the development of protocols, workflows, and peer education programs.54,55

• These processes may be new territory for many physicians, nurses, respiratory therapists, and pharmacists. Nurses and respiratory therapists, for example, may be concerned that they may make a mistake and that patients may self-extubate during a SAT/SBT trial. They may fear confrontations or resistance from the medical staff. To mitigate these concerns:
  — Educate all healthcare providers about the proven methodologies to reduce the risks and incidence of VAP.
  — Share evidence and experience from similar hospitals which demonstrate successful implementation of these processes without complications such as self-extubations.

Use administrative leadership and sponsorship to help remove or mitigate barriers
• Begin implementation with an early adopter physician who can lead and recruit other early adopter champions from among specialty groups and intensivists.
• Enlist an executive sponsor who recognizes the value to the organization and its patients of preventing VAP, and who can provide solutions and resources to address concerns about the burdens of new processes for hospital staff. An executive sponsor can help to staff see the “big picture” on how these changes may benefit the entire organization and advocate for necessary funding, staffing, and supplies, provide bridges over implementation barriers, and educate relevant stakeholders and the governing board.

• Utilize respected senior physician as an “opinion leader” to trial these changes in his or her local unit, and then advocate for organization-wide adoption of successful best practices.

Don’t just change the practice, change the culture
• Instituting the VAP bundle will require a change in culture, particularly among physicians, who will be asked to trade their traditional approach of individualizing mechanical ventilation management for each patient for a standardized and more effective approach. Physicians may be concerned about the perceived loss of control and the risks of shared responsibility; encourage physicians to actively monitor the effectiveness of therapy and the overall condition of the patient.
• Many physicians prefer to learn from peers rather than simply to follow “expert advice.” Use lead physicians as peer educators to advocate for the adoption of improvements such as order sets.
• Nurses and respiratory therapists may be uncomfortable implementing a staff-driven protocol independent of physicians, and have little experience collaborating with other health professionals. Educate staff about the expertise and roles of their colleagues and provide opportunities for collaboration on the development of the new protocols.
• Begin the trial with a small test of change in one unit or area and then disseminate successful results more widely across the organizations. The ideal outcome is the development of team-based care wherein each member of the team (physician, nurse, respiratory therapist) contributes to improved patient quality of care.

TIPS ON USING THE MODEL FOR IMPROVEMENT
• Implement the VAP Bundle one element at a time.
  — Begin with a bundle element that will be easy to trial and will likely be successful and have significant positive impact. For example, implementing HOB elevation is less complicated than implementing SAT/SBT protocols yet greatly reduces VAP risk.
• Testing SAT/SBT protocols
  — Step One: Plan –
    • Do not reinvent the wheel. Use a protocol that has been successful at another hospital and adapt it your facility.
    • Test one step at a time. Do not plan to implement all of the ABCDE recommendations at once. Concentrate first on the ABC, and then add the D and E.
— Step Two: Do –
• Ask a receptive, early-adopter physician on your improvement committee to trial these changes with her next few patients on ventilation.
• Ask a receptive nurse and respiratory therapist on your committee to trial the protocols as well.
• Test “small”: Coordinate with the physician champion to trial the protocol on one patient, with one nurse and one respiratory therapist.

— Step Three: Study –
• Debrief as soon as possible after the test with those involved, asking:
  • What happened?
  • What went well?
  • What didn’t?
  • What do we need to revise for next time?

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

ICU BEST PRACTICE for VENTILATED PATIENTS

H - Head of bed up to 30-45 degrees
E - Enteral feeding and q 2 hour oral care
A - Air mattress and turn q 2 hour
D - DVT prophylaxis
S - Sedation vacation
U - Ulcer prophylaxis
P - Pain control
Appendix II: Example of a Bright-Colored Stripe on Bed Frame
### ICU BEST PRACTICE AUDIT/REPORT

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<tr>
<th>BCD</th>
<th>NOT ICU Status</th>
<th>Patient MR #</th>
<th># Central Lines (include PICCs)</th>
<th>Pediatrician Notified &amp; Documented</th>
<th>Hypothermia Temperature goal reached within 30 minutes and maintained</th>
<th>BGM over 200 write note below for follow up</th>
<th>Sepsis Meets CVS Goal &gt;8</th>
<th>Sepsis Meets Fluid Goal 1.5 – 2.5L Initial</th>
<th>CVS Patient Intake &amp; Output goal achieved</th>
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**NOTICE:** IF INTUBATED OR TRACHEATED

1. Hypothermia: Temperature goal reached within 30 minutes and maintained
2. BGM: 200 write note below for follow up
3. Sepsis: Meets CVS Goal >8
4. Sepsis: Meets Fluid Goal 1.5 – 2.5L Initial
5. CVS: Patient Intake & Output goal achieved
6. TF/TPN: Compliance
7. HOB: 30°–45° Yes circle shift, No X out shift
8. Oral Care: q 2h
9. Chlorhexidine Oral Rinse: q 12H
Appendix IV: Sample SBT/SAT Protocol

The “Wake Up and Breathe” protocol pioneered by Vanderbilt University can be found at:

http://www.mc.vanderbilt.edu/icudelirium/docs/WakeUpAndBreathe.pdf
I AM GETTING MY
ZZZZZZZZZZZZZZ
SLEEP CYCLE IN PROGRESS
DO NOT DISTURB
PLEASE CHECK WITH NURSE BEFORE ENTERING
Appendix VI: Sample Delirium Prevention Protocol

DELIRIUM PREVENTION PROTOCOL

DAYTIME

a. Provide visual and hearing aids during daytime.

b. Encourage communication and reorient the patient frequently.
   i. Ensure the room calendar is up-to-date.
   ii. Introduce oneself with each encounter, providing the current date and time and explaining what will be done, and giving the patient choices regarding his or her care whenever possible.

c. Have the family bring in a few familiar objects from home to display in the patient’s room.

d. Ask the patient/family if they watch television, and, if so, what shows they prefer. Provide the patient with these choices, as well as with daily news on TV or radio.

e. Provide non-verbal music or opt for the patient’s preference.

f. Open shades and keep lights on during the day.

g. Provide an uninterrupted rest period in the afternoons between 1-3pm.

h. Minimize use of physical restraints (including lines and tubes).

i. Provide early and progressive mobility.

NIGHTTIME

PM Care — begin between 2100-2200

a. Ask the patient if toileting is needed (bedpan, bathroom, bedside commode, etc.).

b. Perform oral care (toothbrush, mouth moisture, with assistance or independently); assist the patient in washing his face and hands; perform back care or massage with warmed lotion; offer earplugs.

c. Ask “Do you take or do anything at home to help you sleep? Do you sleep with white noise (fan, TV, music)?”

d. Ensure the call light is within reach and the bed is in the low position; close the shades, dim the lights, close the door (except in the MICU), put the bedside charts outside of the room, and put the “sleep cycle in progress” sign on the door.

e. Minimize noise inside and outside of the room.

f. Allow for minimum of 2 hours of uninterrupted sleep, allowing for a full 90-minute sleep cycle; remove the automatic BP cuff; enter the room with a flashlight or low lighting to perform necessary activities.

i. If patient has been hemodynamically stable in the previous 24 hours, explore extending the uninterrupted sleep period to 4 hours (but only for patients who are unrestrained and can turn themselves)
Appendix VII: Sample Sedation Protocol

St. Joseph Mercy Hospital
Protocol for Sustained Use of Sedatives & Analgesics in Mechanically Ventilated Adult ICU Patients

Is patient comfortable and at goal?

No
Reassess goal daily
Titrte to maintain goal
Perform daily awakening trial

Yes

Rule out reversible causes

Is patient in pain?
(NRS)

Yes
Set goal for analgesia
(recommend less than 4)
or level requested by patient

No

Intersmittent Dosing (preferred)
Fentanyl: 50-100 mcg IV/P q 10 min to goal, then q2h prn
Diazepam: 0.2-1 mg IV/P q2 prn
Morphine: 2-5 mg IV/P q10 min to goal, then q2h prn

Continous Infusion (if IV/P more often than q2h)
Fentanyl: 50-100 mcg IV/P q10 min to goal, then start gtt @ 12.5-200 mcg/hr
Hydromorphone: 0.2-1 IV/mg/hour
Morphine: 2-5 mg IV/P q10 min to goal, then start gtt @ 2-5 mg/hr

Sedation Holiday
Stop sedation at 4:00 am
Allow to awaken to at least RASS - 0
If necessary, restart at 50% prior to dose

Is patient anxious?
(RASS)

Yes
Set goal for sedation
(recommend RASS -1 to 0)

Comprised
ICP/CPP?

No

Intersmittent Dosing (preferred)
Midazolam: 1-2 mg IV/P bolus q10 min to goal, then q2h prn
Lorazepam: 1-2 mg IV/P bolus q10 min to goal, then q2h prn

Continuous Infusion (if IV/P more often than q2h)
Midazolam: 1-2 mg IV/P then start gtt @ 1-2 mg/hour to max of 30 mg/hour.
Lorazepam: 1-2 mg IV/P q10 min to goal, then start gtt @ 1-2 mg/hr to max of 15 mg/hr.
Propofol: Start gtt @ 5 mcg/kg/min to max of 75 mcg/kg/min

Propofol: Start gtt @ 5 mcg/kg/min to max of 75 mcg/kg/min

Yes

Propofol: Start gtt @ 5 mcg/kg/min to max of 75 mcg/kg/min

Convert to benzos

Greater than 3 days Propofol?

Yes

Haloperidol: 5-10 mg IV/P q 12h

And
Go to Delirium Protocol

No

Is patient delirious?
(positive CAM-ICU or physician diagnosis)

Yes

For Intermittent Dosing
If undersedated, rebolus and/or increase dose by 50% or shorten interval between doses
If oversedated, hold until at goal then decrease dose by 50% or lengthen interval between doses

For Continuous Infusions (refer to RAAS order set)
If undersedated: rebolus and/or increase gtt rate by 25%
If oversedated: hold gtt until at goal then restart at 50% prior rate or consider intermittent dosing

For Patients on Neuromuscular Blockers
Never hold sedatives or analgesics until NMB stopped and paralysis resolved

NRS = Numerical Rating Scale
RASS = Richmond Agitation & Sedation Scale
CPP = Cerebral Perfusion Pressure
CAM-ICU = Confusion Assessment Method for the ICU
ICP = Intracranial Pressure

* older patients may be started on much lower doses, e.g. 1-2 mg q 12h

CONFUSION ASSESSMENT METHOD IN THE ICU

Delirium Assessment (CAM-ICU): 1 AND 2 AND (Either 3 or 4)

1. Acute Onset or Fluctuating Course
   - An acute change from mental status baseline?
   - Or Patient’s mental status fluctuating during the past 24 hours
   - **Less than 3 Errors**
     - **Stop**
     - No delirium
   - **Greater than or equal to 3 Errors**
     - **If RASS is other than zero**
     - Patient is Delirious
     - **If RASS is 0**
     - **Stop**
     - No delirium

2. Inattention
   - Please read the following ten letters and ask the patient to squeeze when you say
     the letter A: S A V E A H A R T
     - Scoring: Error: when patient fails to squeeze on the letter “A”.
     - Error: when the patient squeezes on any letter other than “A”.
   - **Stop**
   - No delirium

3. Altered Level of Consciousness (“actual” RASS)
   - If RASS is zero, or if still on sedation or sedation still lingering, proceed to next step
   - **Greater than or equal to 2 Errors**
     - **Patient is Delirious**
   - **Less than 2 Errors**
     - **Stop**
     - No delirium

4. Disorganized Thinking
   1. Will a stone float on water? (Or: Will a leaf float on water?)
   2. Are there fish in the sea? (Or: Are there elephants in the sea?)
   3. Does one pound weigh more than two pounds? (Or: Do two pounds weigh
      more than one?)
   4. Can you use a hammer to pound a nail? (Or: Can you use a hammer to cut wood?)
   OR
   Command: Say to patient: “Hold up this many fingers” (Examiner holds two fingers in front of
   patient) “Now do the same thing with the other hand” (Not repeating the number of fingers). If
   patient is unable to move both arms for the second part, ask patient “add one more finger”
## RASS WORKSHEET

### The Richmond Agitation and Sedation Scale: The RASS* Score Term Description

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<th>Score</th>
<th>Term</th>
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<td>+4</td>
<td>Comative</td>
<td>Overtly combative, violent, immediate danger to staff</td>
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<td>+3</td>
<td>Very agitated</td>
<td>Pulls or removes tube(s) or catheter(s); aggressive</td>
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<td>+2</td>
<td>Agitated</td>
<td>Frequent non-purposeful movement, fights ventilator</td>
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<td>+1</td>
<td>Restless</td>
<td>Anxious but movements not aggressive, vigorous</td>
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<td>0</td>
<td>Alert and calm</td>
<td>Not fully alert, but has sustained awakening (eye-opening / eye contact) to voice (greater than 10 seconds)</td>
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<td>-1</td>
<td>Drowsy</td>
<td>Briefly awakens with eye contact to voice (less than 10 seconds)</td>
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<td>-2</td>
<td>Light sedation</td>
<td>Movement or eye opening to voice (but no eye contact)</td>
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<tr>
<td>-3</td>
<td>Moderate sedation</td>
<td>No response to voice, but movement or eye opening to physical stimulation</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation</td>
<td>No response to voice or physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarousable</td>
<td>No response to voice or physical stimulation</td>
</tr>
</tbody>
</table>

### Procedure for RASS Assessment

1. **Observe patient**
   a. Patient is alert, restless or agitated. *(score 0 to +4)*

2. **If not alert, state patient’s name and say to open eyes and look at speaker.**
   a. Patient awakens with sustained eye opening and eye contact. *(score -1)*
   b. Patient awakens with eye opening and eye contact, but not sustained. *(score -2)*
   c. Patient has any movement in response to voice but no eye contact *(score -3)*

3. **When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.**
   a. Patient has any movement to physical stimulation. *(score -4)*
   b. Patient has no response to any stimulation. *(score -5)*
Appendix X: Sample Early Progressive Mobility Protocol

EARLY PROGRESSIVE MOBILITY PROTOCOL

Step 1 – Safety Screening

Evaluate Daily

(Patient must meet all criteria)

M – Myocardial stability
   • No evidence of active myocardial ischemia x 24 hrs.
   • No dysrhythmia requiring new antidysrhythmic agent x 24 hrs.

O – Oxygenation adequate on:
   • FiO₂ < 0.6
   • PEEP < 10 cm H₂O

V – Vasopressor(s) minimal
   • No increase of any vasopressor x 2 hrs.

E – Engages to voice
   • Patient responds to verbal stimulation

Fails

Re-evaluate in 24 hours

Passes

Step 2 – Progressive Mobility

Level 1

Passive ROM TID
   Turn Q 2 hrs.
   Active resistance PT
   Sitting position 20 mins. TID

Able to move arm against gravity

Level 2

Passive ROM TID
   Turn Q 2 hrs.
   Active resistance PT
   Sitting position 20 mins. TID

Sitting on edge of bed

Level 3

Passive ROM TID
   Turn Q 2 hrs.
   Active resistance PT
   Sitting position 20 mins. TID

Able to move leg against gravity

Level 4

Passive ROM TID
   Turn Q 2 hrs.
   Active resistance PT
   Sitting position 20 mins. TID

Sitting on edge of bed

Ambulation (marching in place, walking in halls)

REFERENCES


