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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)
<table>
<thead>
<tr>
<th>Primary Drivers</th>
<th>Ideas to Test</th>
</tr>
</thead>
</table>
| Elevate the Head of the Bed to between 30-45 degrees.                         | • 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.                                                                                                                                                                                                                                                                 |
| Peptic ulcer disease (PUD) prophylaxis                                       | • 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.                                                                                                                                                                                                                   |
| Venous Thromboembolism (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.                                                                                                                                                                                                                                                                                                                                 |
| ABCDE Bundle                                                                 | • 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.                                                                                                                                 |
| Oral Care                                                                     | • 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](http://www.cdc.gov/mmwr/preview/mmwrhtml/00045365.htm)
- Society of Hospital Medicine Guidelines for Preventing VAP. Retrieved at: [http://www.hospitalmedicine.org/AM](http://www.hospitalmedicine.org/AM)
- IHI How to Guide Preventing VAP. Retrieved at: [http://www.ihi.org/knowledge/Pages/Tools](http://www.ihi.org/knowledge/Pages/Tools)
**Prevention of Ventilator Associated Pneumonia Driver Diagram**

**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.

<table>
<thead>
<tr>
<th>Primary Drivers</th>
<th>Secondary Drivers</th>
<th>Change Ideas</th>
</tr>
</thead>
</table>
| 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 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. |
<table>
<thead>
<tr>
<th>Primary Drivers</th>
<th>Secondary Drivers</th>
<th>Change Ideas</th>
</tr>
</thead>
</table>
|                 | Include VTE prophylaxis on daily checklist | • 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 Ramsey Score.  
• Modify ICU orders to default activity level to “as tolerated.”  
• Implement an early progressive mobility protocol. |
| 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. | |
| Oral Care       | Perform regular oral care with an antiseptic solution, brush teeth, and perform oral and pharyngeal suctioning. | • Include teeth brushing twice a day in order sets for all ventilated patients.\(^2\)  
• Include routine oral care every 2-4 hours with an antiseptic solution. |

\(^1\) Richmond Agitation Sedation Scale (RASS)  
<table>
<thead>
<tr>
<th>Primary Drivers</th>
<th>Secondary Drivers</th>
<th>Change Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Educate the RN staff about the rationale supporting good oral hygiene and its potential benefit in reducing ventilator-associated pneumonia.</td>
<td>antiseptic mouthwash swab to clean the oral cavity and teeth.</td>
</tr>
<tr>
<td></td>
<td>• Use Chlorhexidine 0.12% mouthwash at least daily (many studies cite every 12 hours) as part of order sets for all ventilated patients.⁴</td>
<td>• Use Chlorhexidine 0.12% mouthwash at least daily (many studies cite every 12 hours) as part of order sets for all ventilated patients.⁴</td>
</tr>
<tr>
<td></td>
<td>• Create visual cues (e.g. empty holders of oral care products) to indicate compliance with oral care.</td>
<td>• Create visual cues (e.g. empty holders of oral care products) to indicate compliance with oral care.</td>
</tr>
<tr>
<td></td>
<td>• Include Respiratory Therapy in performing oral care, make it a joint RN and RT function.</td>
<td>• Include Respiratory Therapy in performing oral care, make it a joint RN and RT function.</td>
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</tbody>
</table>

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.

Suggested AIMs
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 secretions2,3,4,5.

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

Secondary Driver: Use visual cues
Visual cues are important to 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.6

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. 13

“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. 14 Additionally, bacterial colonization of the stomach can lead to infection of the respiratory tract 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 (PPI) may be efficacious, and serve as an alternative to sucralfate or an H2 antagonist.17
• 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.\textsuperscript{18}

- 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.\textsuperscript{19} The addition of mechanical prophylaxis to pharmacological prophylaxis has shown some benefits in VTE reduction.\textsuperscript{20}

**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” VTE Prophylaxis 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.
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 or each individual patient.21 “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.”22,23

ABCDE Bundle components include:

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. 24,25,26

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 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.27,28,29

- Process Measure: Daily audit of SAT/SBT compliance and documentation of rationale for non-compliance (e.g. contraindications)

The use of non-physician staff-driven protocols has been found to be very effective in assessing readiness to wean from the ventilator and have demonstrated a reduction in VAP.30 By developing staff-driven protocols and incorporating SAT and SBT into the daily care of the ventilator patient, patients will experience fewer days on the ventilator and a shorter ICU stay.31,32 (See Appendix IV for a link to a suggested 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: “D” - Sedation should be goal oriented

Sedation is 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.33,34 (See Appendix VI for a sample Delirium Prevention protocol and Appendix VII for a sample Sedation protocol).

Change Ideas: Implement a sedation protocol

- Assess patients at least daily for confusion/delirium. (See Appendix VIII for an assessment algorithm).
- Administer sedation as ordered by the physician, according to a scale such as a RASS, SAS or Modified Ramsey Score. These scores help standardize communications, are more accurate, and take less time than qualitative descriptions of level of sedation. (See Appendix IX for a sample RASS worksheet).
• Assess at least daily if the target RASS/Modified Ramsey/SAS goal is met. If not, audit and analyze the reasons for missing the target.

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.\textsuperscript{35,36,37} This weakness impairs ventilator weaning and functional mobility and can persist well after hospital discharge.\textsuperscript{38} 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.\textsuperscript{39,40} “Progressive mobility is defined as a series of planned movements in a sequential manner beginning at a patient’s current mobility states with a goal of returning to his/her baseline”.\textsuperscript{41} (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.\textsuperscript{42,43}

Oral Care
Oral care may seem simple, but 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.44

Change Ideas: Routine Oral Care Standardized
• Teeth brushing twice a day in order sets for all ventilated patients.45,46
• Include routine oral care (at least every 2–4 hours) with an antiseptic mouthwash swab to clean the oral cavity and teeth.47
• Order Chlorhexidine 0.12% mouthwash at least daily (many studies cite every 12 hours) for all ventilated patients.48,49,50
• 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.51,52

“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:
  o Checking 5 ventilated patients to determine bundle compliance for each element.
  o Was the sedative infusion truly turned off and, if so, for how long?
  o Was the infusion restarted at the same dose or was the dose lowered if possible?
  o If an intermittent pneumatic compression device was used for mechanical VTE prophylaxis, was it actually operating/functioning?
  o 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.
  o 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.
  o 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 in improvement teams to collaborate in the development of protocols, workflows, and peer education programs.\(^{53,54}\)

• 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:
  o Educate all healthcare providers about the proven methodologies to reduce the risks and incidence of VAP.
  o Share evidence and experience from similar hospitals which demonstrate successful implementation of these processes without complications such as self-extubations.

**Use administrative leadership 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, but 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 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 for 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 to 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.
ICU BEST PRACTICE
for
VENTILATED PATIENTS

H
ead of bed up 30 – 45 degrees
E
teral 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: Example of a Bright-Colored Stripe on Bed Frame
### Appendix III: Example of a Best Practice Checklist

#### ICU BEST PRACTICE AUDIT/REPORT

<table>
<thead>
<tr>
<th>BED</th>
<th>Patient MR #</th>
<th># Central Lines (includes 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 CVP Goal ≥8</th>
<th>Sepsis Meets Fluid Goal 1.5 - 2 L initial</th>
<th>CVS Patient Intake &amp; Output goal achieved</th>
<th>INTUBATED</th>
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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
Appendix V: Sample Communication

I AM GETTING MY ZZZZZZZZZZZZ

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

Appendix VII: Sample Sedation Protocol

Is patient comfortable and at goal?

- No
  - Rule out reversible causes
  - Set goal for analgesia (recommend less than 4) or level requested by patient

- Yes
  - Reassess goal daily
  - Titrante to maintain goal
  - Perform daily awakening trial

Intermittent Dosing (preferred)
- Fentanyl: 50-100 mcg IV P 10 min to goal, then q2h
- Diamorphine: 0.2-1 mg IV P q2 pm
- Morphine: 2-6 mg IV P q10 min to goal, then q2h pm

Continuous Infusion (if IVP 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/hour

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

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

Is patient in pain? (NRS)

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

- No
  - Comprised [CPP/CVP]?
  - Convert to benzod.
  - Greater than 3 days Propofol?

Is patient anxious? (RASS)

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

- No
  - Haloperidol: 5-10 mg IV P q12h

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

- Yes
  - Go to Delirium Protocol

- No
  -...
Appendix VIII: Confusion/Delirium Assessment

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
   Yes
   NO
   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
   Error: when patient fails to squeeze on the letter “A”.
   Error: when the patient squeezes on any letter other than “A”.
   Less than 3 Errors
   Stop
   No delirium

If RASS is −4 or −5
STOP
Reassess patient at later time

Greater than or equal to 3 Errors
If RASS is other than zero
Stop
Patient is Delirious

3. Altered Level of Consciousness (“actual” RASS)
   If RASS is zero, or if still on sedation or sedation still lingering, proceed to next step

0 RASS

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”

Greater than or equal to 2 Errors
Less than 2 Errors
Patient is Delirious
Stop
No delirium
# RASS Worksheet

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

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

## Procedure for RASS Assessment

1. **Observe patient**
   a. Patient is alert, restless or agitated. \( (0 \text{ to } 4) \)

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. \( (1) \)
   b. Patient awakens with eye opening and eye contact, but not sustained. \( (2) \)
   c. Patient has any movement in response to voice but no eye contact \( (3) \)

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. \( (4) \)
   b. Patient has no response to any stimulation. \( (5) \)
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:
- FO2 < 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
- Sitting on edge of bed

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
- Sitting on edge of bed
- Active transfer to chair 20 mins./day

Level 4
- Passive ROM TID
- Turn Q 2 hrs.
- Active resistance PT
- Sitting position 20 mins. TID
- Sitting on edge of bed
- Active transfer to chair 20 mins./day
- Ambulation (marching in place, walking in halls)

Able to move arm against gravity

Website.

Retrieved at:
References

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