HRET
HEALTH RESEARCH & EDUCATIONAL TRUST

PARTNERSHIP FOR PATIENTS

2018 UPDATE

PREVENTING VENTILATOR-ASSOCIATED EVENTS

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PREVENTING VENTILATOR-ASSOCIATED EVENTS *CHANGE PACKAGE*

ACKNOWLEDGEMENTS

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How to Use this Change Package

This change package is intended for hospitals participating in the Hospital Improvement Innovation Network Network (HIIN) project led by the Centers for Medicare & Medicaid Services (CMS) and the Partnership for Patients (PFP); it is meant to be a tool to help you make patient care safer and improve care transitions. This change package is a summary of themes from the successful practices of high-performing health organizations across the country. It was developed through clinical practice sharing, organization site visits and subject matter expert contributions. This change package includes a menu of strategies, change concepts and specific actionable items that any hospital can choose to implement based on need. Hospitals may use it to begin testing for purposes of improving patient quality of life and care. This change package is intended to be complementary to literature reviews and other evidence-based tools and resources.

PART 1: AEA DEFINITION AND SCOPE

Mechanically ventilated patients are at high risk for complications categorized as ventilator-associated events (VAE). VAE has two subsets: 1.Ventilator associated conditions (VAC) include fluid overload, atelectasis and ARDS, and 2. Infection-related ventilator-associated conditions (IVAC) include pneumonia. Evidence-based interventions can reduce the risk and incidence of these complications. These interventions are: head-of-bed elevation to 30 to 45 degrees, oral care at regular intervals, use of subglottic suction, low volume tidal volumes, and the implementation of the ABCDEF bundle elements (i.e., Assess, prevent and manage pain, Both spontaneous awakening trials and Breathing trials, Choice of analgesia and sedation, Delirium assessment, prevention and management, Exercise, and Early progressive mobility, and Family engagement and empowerment).[5,6]

This revised Preventing Ventilator-Associated Events Change Package published by HRET acknowledges the evolution of science and the following key revisions:

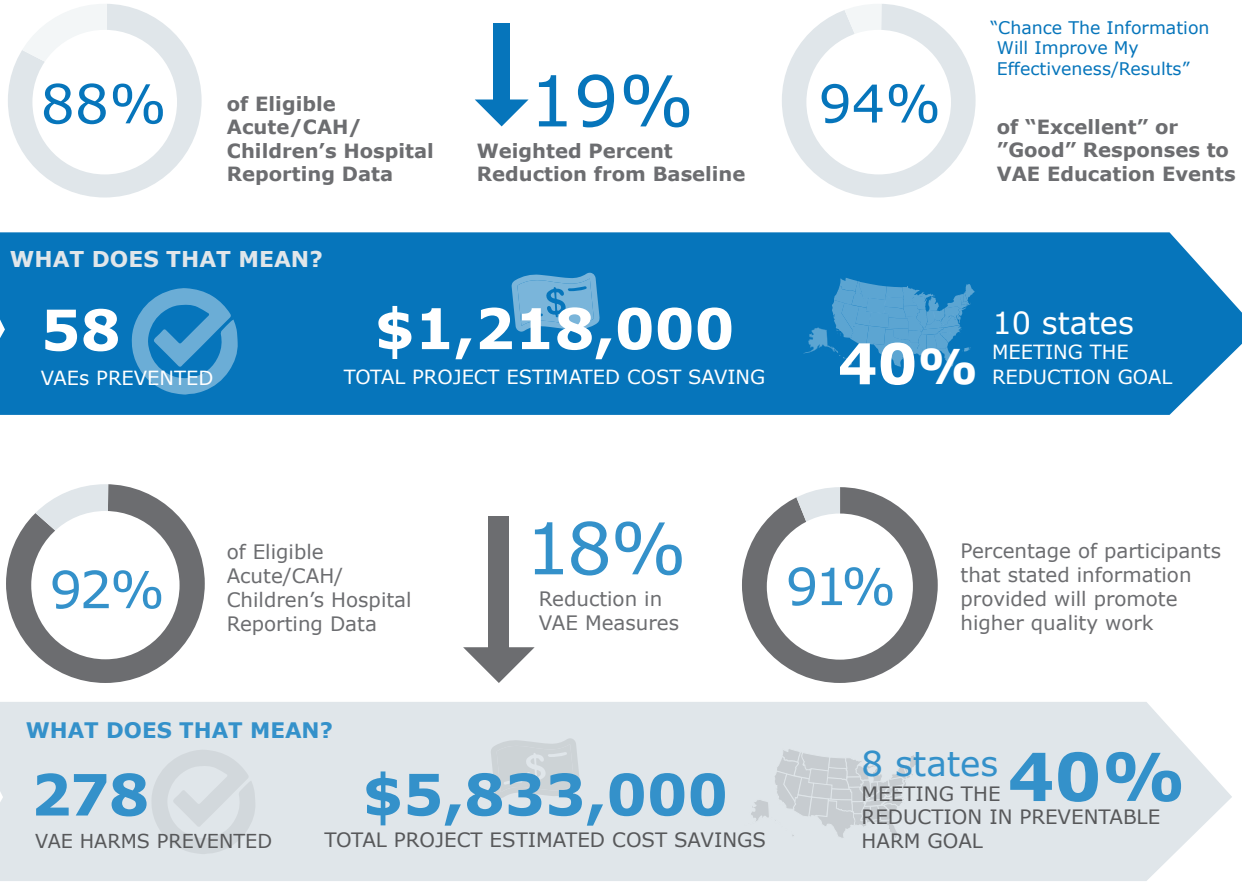
The 2018 updates to the Preventing Ventilator-Associated Events change package reflects the current evidence-based practice and shifts the improvement work from the Ventilator-Associated Pneumonia (VAP) bundle to the the prevention of all Ventilator-Associated Events, not just Ventilator-Associated Pneumonia.

Magnitude of the Problem

Over a quarter million patients in the United States receive mechanical ventilation annually, putting them at risk for acute lung injury, including mortality related to pneumonia and acute respiratory distress syndrome, among other lung injuries and death.[5,6,7] In 2011, nearly 50,000 patients developed VAP during the course of their acute care hospital stay and 157,000 patients were diagnosed with health care-associated pneumonia.[8] Of patients on mechanical ventilation, the elderly (aged 85 years and older) are at a higher risk for lung injury than younger.[9] Poor outcomes after mechanical ventilation include extended time on mechanical ventilation, longer stays in the ICU and hospital, increased health care costs and increased risk of disability and death.[10] Mortality attributed to ventilator-associated pneumonias (VAPs) is estimated to be between 9 percent and 13 percent.[11,12] It is predicted that a VAP diagnosis costs an additional $41,000 and leads to a 14-day increase in length of stay for acute care hospital patients.[13]

> HEN 1.0 Progress

> Through the work of the AHA/HRET HEN, from 2011 through 2014, over 1,400 hospitals worked to prevent and reduce VAE. Results summarized below.



> HIIN Reduction Goals

- Reduce the prevalence of ventilator-associated events (VAE) by 20 percent by September 27, 2018.

PART 2: MEASUREMENT

A key component to making patient care safer in your hospital is to track your progress toward improvement. This section outlines the nationally recognized process and outcome measures in which you will be collecting and submitting data as part of the AHA/HRET HIIN. Collecting these monthly data points at your hospital will guide your quality improvement efforts as part of the Plan-Do-Study-Act (PDSA) process. Tracking your data in this manner will provide valuable information you need to study your data across time and determine the effect your improvement strategies have in your hospital at reducing patient harm. Furthermore, collecting these standardized metrics will allow the AHA/HRET HIIN to aggregate, analyze and report its progress toward reaching the project's 20/12 goals across all AEAs by September 2018.

Nationally Recognized Measures: Process and Outcome

Please download and reference the encyclopedia of measures (EOM) on the HRET HIIN website for additional measure specifications and for any updates after publication at: http://www.hret-hiin.org/data/hiin_eom_core_eval_and_add_req_topics.pdf

HIIN Evaluation Measure

- Ventilator-associated condition (VAC) – all facilities
- Infection-related, ventilator-associated complication (IVAC) – all facilities

> Process Measures

- Percentage of patients who underwent the ABCDEF bundle assessment
- Percentage of eligible patients who receive spontaneous awakening trial
- Percentage of eligible patients who receive spontaneous breathing trial

PART 3: APPROACHING YOUR AEA

Suggested Bundles and Toolkits

- Society of Critical Care Medicine ICU Liberation. Retrieved at: www.iculiberation.org
- Vanderbilt ICU Delirium and Cognitive Impairment Study Group. Retrieved at: www.icudelirium.org
  - ABCDEF Bundle
  - Protocols
  - Assessment tools
  - Patient and family education
  - For key tools and resources related to preventing and reducing sepsis mortality, visit: http://www.hret-hiin.org/
- The "Wake Up and Breathe" protocol pioneered by Vanderbilt University. Retrieved at: http://www.mc.vanderbilt.edu/icudelirium/docs/WakeUpAndBreathe.pdf
- AACN Practice Alert. Delirium Assessment and Management. Retrieved at: http://www.aacn.org/wd/practice/content/practicealerts/delirium-practice-alert.pcms?menu=practice
- Iatrogenic Delirium Change Package from HRET-HIIN. Retrieved at: http://www.hret-hiin.org/topics/iatrogenic_delirium/index.shtml
- IDSA and SHEA Compendium on VAP 2014 Update. Retrieved at: http://www.jstor.org/stable/10.1086/591062
- CDC/NHSN Surveillance for VAE. Retrieved at: http://www.cdc.gov/nhsn/acute-care-hospital/vae/
- VAE Calculator Version 3. Retrieved at: www.cdc.gov/nhsn/VAE-calculator/index.html
- For key tools and resources related to preventing and reducing VAE, visit www.hret-hiin.org

Investigate Your Problem and Implement Best Practices

DRIVER DIAGRAMS: A driver diagram visually demonstrates the causal relationship between your change ideas, secondary drivers, primary drivers and your overall aim. A description of each of these components is outlined in the table below. This change package is organized by reviewing the components of the driver diagram to first, help you and your care team identify potential change ideas to implement at your facility and second, to show how this quality improvement tool can be used by your team to tackle new process problems.

AIM	PRIMARY DRIVER	SECONDARY DRIVER	**Change Idea**
		SECONDARY DRIVER	**Change Idea**
	PRIMARY DRIVER	SECONDARY DRIVER	**Change Idea**

AIM: *A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.*

PRIMARY DRIVER: *System components or factors that contribute directly to achieving the aim.*

SECONDARY DRIVER: *Action, interventions or lower-level components necessary to achieve the primary driver.*

CHANGE IDEAS: *Specific change ideas that will support or achieve the secondary driver.*

Drivers in This Change Package

PREVENT VAE	ELEVATE THE HEAD OF BED (HOB) TO BETWEEN 30-45 DEGREES	USE VISUAL CUES	**Change Idea**
		IDENTIFY A DESIGNATED STAFF MEMBER TO CHECK HOB ELEVATION ON EACH SHIFT	**Change Idea**
		ESTABLISH A PROCESS FOR HOB ELEVATION IN NON-ICU AREAS AND DURING TRANSPORT	**Change Idea**
		USE ORDER SETS FOR HOB ELEVATION CHECKS	**Change Idea**
	MANAGE SUBGLOTTIC SECRETION DRAINAGE	USE ENDOTRACHEAL TUBE (ETT) WITH SUBGLOTTIC SECRETION MANAGEMENT AND CREATE PROTOCOLS FOR REGULAR ORAL CARE	**Change Idea**
	USE LOW VOLUME TIDAL VOLUME VENTILATION	INITIATE LOW VOLUME TIDAL VOLUME VENTILATION UNLESS CONTRAINDICATED	**Change Idea**
		ENLIST INTERDISCIPLINARY SUPPORT	**Change Idea**
	USE THE ABCDEF BUNDLE	**"A"** — ASSESS, PREVENT AND MANAGE PAIN	**Change Idea**
		"B" — BOTH SPONTANEOUS AWAKENING TRIALS (SAT) AND SPONTANEOUS BREATHING TRIALS (SBT)	**Change Idea**
		"C" — CHOICE OF ANALGESIA AND SEDATION	**Change Idea**
		"D" — DELIRIUM MONITORING AND MANAGEMENT	**Change Idea**
		"E" — EARLY PROGRESSIVE MOBILIZATION AND AMBULATION	**Change Idea**
		"F" — FAMILY ENGAGEMENT AND EMPOWERMENT	**Change Idea**

Primary Driver:

ELEVATE THE HEAD OF BED (HOB) TO BETWEEN 30-45 DEGREES

Elevating the head of the bed to between 30 to 45 degrees is a simple nursing measure that has resulted in VAP reduction. Keeping the HOB elevated has been shown to help prevent aspiration of gastric contents and secretions.[3,14,15,16,17,18,19]

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 as staff often underestimates the angle of the HOB. One research study found that HOB angle was perceived correctly by only 50 percent to 86 percent of clinicians.[20]

Change Ideas

Standardizing the processes of care has been shown to increase the number of patients who are placed in a semi-recumbent position.[21,22] Engage staff nurses in collaborating and developing visual cues that are effective in their environment and supports unit workflow. See Appendix II for an example of a VAE Prevention Visual Cue and Appendix III for Colored Stripe on Bed Frame Side Rail visual cue. Examples of visual cues include:

- Using a line (red tape) on the wall that can only be seen if the head of the bed is below a 30 degree angle.[23]
- 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.
- Including the interventions on nursing flow sheets.
- Incorporating HOB elevation into the standardized order set.

Secondary Driver > IDENTIFY A DESIGNATED STAFF MEMBER TO CHECK HOB ELEVATION ON EACH SHIFT

The environment of an intensive care unit is a busy and stressful one. Clinicians are confronted with multiple urgent demands for attention. Engagement of the entire team, including bedside nurses, intensivists, nurses' aides, respiratory therapists and the charge nurse is essential to ensure that preventive measures such as elevated HOB are implemented. See Appendix IV for an example of a Best Practices Checklist.

Change Ideas

- Assign respiratory therapy staff or a unit assistant to observe for compliance with HOB greater than 30 degrees every one to two hours and notify bedside nurse if HOB is not in compliance.
- Include interventions on nursing flow sheets.
- 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 HOB elevation.
- If HOB elevation is contraindicated, communicate and document the rationale and contraindication.

Secondary Driver > ESTABLISH A PROCESS FOR HOB ELEVATION IN NON-ICU AREAS AND DURING TRANSPORT

At-risk occasions for aspiration include when a patient is in the emergency department after intubation awaiting an ICU bed, or during transport within the hospital (as patients travel to and from locations for diagnostic testing and procedures) or between facilities (e.g., from a referring facility to an accepting facility).

Change Ideas

> Work with the ED staff to incorporate HOB elevation into their workflow once patient is hemodynamically stable. Ventilated patients do not routinely remain for more than a few hours in the ED. The creation of a checklist to ensure that atypical, but essential care interventions, such as elevated HOB are performed is helpful.

> Use respiratory therapy staff, as they round and care for patients on ventilators in the ED, to double-check and ensure HOB elevation is performed.

> Educate transport staff on the benefits of HOB elevation and how it should be performed.

> Partner with your referring hospitals and nursing homes to implement essential bundle elements such as HOB elevation while the patient is awaiting transport.

> Work with ambulance personnel to establish the HOB practice during transport.

Secondary Driver > USE ORDER SETS FOR HOB ELEVATION CHECKS

Research suggests that standardized order sets can be effective in improving compliance with evidence-based practices in areas such as VAP reduction, improved stroke care and sepsis. Standardized order sets have been shown to increase patient safety and improve outcomes for multiple patient conditions.[24,25,26,27]

Change Ideas

> If using an electronic health record (EHR), institute computer-based pop-up reminders.

> Discuss procedures during multidisciplinary rounds to ensure that all of the bundle components have been understood and implemented.

> Establish a process to communicate contraindications for HOB elevation for an individual patient.

Suggested Process Measures for Your Test of Change

- Daily audit of the percentage HOB elevation compliance and/or documentation of contraindications to HOB elevation

Hardwire the Process

Hardwiring tactics for the HOB elevation include many of the change ideas. Ongoing monitoring of compliance for HOB elevation and performance feedback to staff is vital to sustain recommended practices. Implement routine reminders to help the intervention become part of the daily care processes, such as including HOB elevation on the daily audit checklist and on nursing and respiratory care flow sheets.

Primary Driver:

MANAGE SUBGLOTTIC SECRETION DRAINAGE

Secondary Driver > USE ENDOTRACHEAL TUBE (ETT) WITH SUBGLOTTIC SECRETION MANAGEMENT

New evidence on subglottic secretion drainage as a preventive measure for ventilator-associated pneumonia supports the utilization of this type of ETT. Microaspirations of secretions introduces bacterial pathogens into the lower respiratory tract and is the main cause of ventilator-associated pneumonia. Endotracheal tubes with subglottic secretion drainage can potentially reduce this and, therefore, the incidence of ventilator-associated pneumonia.[93,94] Swabbing a patient's mouth with mouthwash has been recommended for comfort, but recent studies have demonstrated that oral care can also decrease microbes in the oral cavity and in aspirated secretions, further reducing the risk for VAE.[95]

Change Ideas

> Engage your ICU leaders and respiratory care leaders to influence the purchase and use of ETT with subglottic suction.

> Place subglottic suction ETT in crash cart and emergency intubation supplies.

> Intubate patients who have anticipated mechanical ventilation of greater than 72 hours with subglottic suction ETT.

Suggested Process Measures for Your Test of Change

> Percentage of patients with subglottic suction ETT who are intubated >72 hours.

> Compare rates of IVAC in patients with subglottic suction ETTs versus those without subglottic suction ETTs.

Secondary Driver > CREATE PROTOCOLS FOR REGULAR ORAL CARE

Protocols support regular oral care with the use of an antiseptic solution, brushing of teeth, and performance of oral and pharyngeal suctioning. Oral care is a basic task that can positively impact VAE prevention.[96]

Change Ideas

> Brush teeth twice a day, as per order sets in all ventilated patients.[97]

> Include routine oral care (at least every two to four hours) with an antiseptic mouthwash swab to clean the oral cavity and teeth.[98]

> Create visual cues to demonstrate compliance with oral care. Examples include keeping empty holders of oral care products by the bedside or dating and timing oral care products used.

> Engage respiratory therapy in the performance of oral care; make it a joint nursing and respiratory therapy function.

> Use a whiteboard to document the delivery of oral care; list scheduled care times with ability to sign off to make missed interventions more obvious.

Suggested Process Measures for Your Test of Change

- Daily audit percentage of oral care compliance

Hardwire the Process

> Hardwiring the management of subglottic secretions requires multidisciplinary approach and support. New equipment procurement (ETT with subglottic suction) and utilization is an important strategy to decrease VAE. Failure-free oral care also requires the ready availability of necessary supplies and consistent use of standard order sets for oral care.. Monitoring daily compliance by leadership and peers will reinforce the priority and maintain reliability. Additionally, setting up reminders or automatic prompts for oral care will help ensure care is performed reliably.

Primary Driver:

USE LOW VOLUME TIDAL VOLUME VENTILATION

Low volume tidal volumes ventilation is designed to protect the lungs from excessive stretch resulting in improvements in clinical outcomes in patients with acute lung injury and acute respiratory distress syndrome.

Secondary Driver > INITIATE LOW VOLUME TIDAL VOLUME VENTILATION UNLESS CONTRAINDICATED

Low volume tidal volume ventilation strategies have been shown to decrease pulmonary complications due to barotrauma and the development of ARDS in patients without ARDS. These strategies use 6 ml/kg predicted body weight (PBW) for all ventilated patients, as lung-protective ventilation.[99,100,101]

Change Ideas

> Ensure all ventilator order sets have low volume tidal volume 6ml/kg as a default order.

> Monitor tidal volumes every shift.

> Use PBW calculator to ensure appropriate tidal volumes. (Appendix IV)

Suggested Process Measures for Your Test of Change

> Percentage of patients on mechanical ventilation with set tidal volumes of 6ml/kg PBW

Secondary Driver > ENLIST INTERDISCIPLINARY SUPPORT

Multidisciplinary teamwork education and support are keys to success to improve compliance in mechanical ventilation management.[102]

Change Ideas

> Communicate optimal tidal volumes during multidisciplinary rounds

> Educate all disciplines regarding the advantages of low volume tidal volumes (respiratory, nursing, physician)

Suggested Process Measures for Your Test of Change

- Percentage of rounds in which tidal volume is discussed and verified to be 6 ml/kg PBW.

Hardwire the Process

Hardwiring the utilization of low volume tidal volumes requires education, interdisciplinary vigilance and development of tools that support this practice. Examples of hardwiring include inclusion in ICU or ventilator order sets inclusion in multidisciplinary rounds and respiratory therapy daily audits. Each of these examples provides real-time feedback to direct caregivers and providers and allows for immediate correction of omissions.

Primary Driver:

USE THE ABCDEF BUNDLE

The ABCDEF bundle extends the original VAP bundle and its HOB, PUD prophylaxis, VTE prophylaxis and oral care interventions. The ABCDEF bundle was developed to improve the health of ventilated patients by reducing their risk of oversedation, improve patient, immobility, improve patient comfort, reduce the risk of infection and decrease the risk of mental status changes and long-term morbidity.[36] 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.

ABCDEF bundle components include:[37,38,39]

A — Assess, prevent and manage pain

B — Both spontaneous awakening trials (SAT) and spontaneous Breathing trials (SBT)

C — Choice of analgesia and sedation

D — Delirium: assess, prevent and manage

E — Exercise and Early mobility

F — Family engagement and empowerment

Secondary Driver > "A" — ASSESS, PREVENT AND MANAGE PAIN

Caregivers should be aware that patients who receive mechanical ventilation report pain as part of their suffering regardless of whether or not they underwent invasive procedures.[40] Poor pain control is a risk factor in critically ill patients for nosocomial infection, longer mechanical ventilation duration and may precipitate delirium.[41]

In January 2013, the updated practice guidelines for pain, agitation, and delirium (PAD) were published.[42] The goal of the guidelines is to improve the comfort and outcomes of critically ill adult patients using a patient-centered, evidence-based approach.[43] Key recommendations from the PAD guidelines are to treat pain before anxiety, consider goal-directed sedation using a validated scale, and avoid the use of benzodiazepines.

According to the 2013 PAD Guidelines[44]:

> Pain should be routinely monitored in all adult ICU patients.

> Vital signs alone should not be used for pain assessment but as a cue to further assess pain.

> Intravenous opioids may be the first line choice to treat non-neuropathic pain in critically ill patients.

Change Ideas

> Assess pain routinely, i.e., include pain assessment with vital signs.

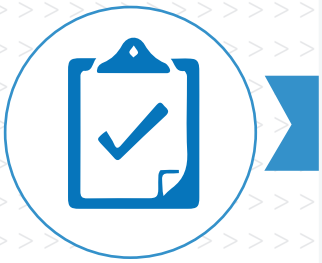
> Use a validated pain assessment tool, i.e., the Critical-Care Pain Observation Tool or the Behavioral Pain Scale.[45]

> Include pain management in interdisciplinary rounds and nurse-to-nurse handoffs.

Secondary Driver > "B" — BOTH SPONTANEOUS AWAKENING TRIALS (SAT) AND SPONTANEOUS BREATHING TRIALS (SBT)

Sedation in a mechanically ventilated patient may be necessary to control anxiety, reduce pain and manage oxygenation needs. However, the use of sedation can prolong the duration of mechanical ventilation.[46,47,48] Daily sedation interruption or a light target level of sedation should be routinely used in adult ICU patients on mechanical ventilation as recommended by the 2013 PAD Guidelines. This enables patients receiving sedation to have a neurological assessment. 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.[49,50,51]

Coordinate SAT and SBT to maximize weaning opportunities when patient sedation is minimal. Nursing and respiratory therapy should work as a team to ensure patient safety and to address the selected VAE prevention bundle interventions. SBT will fail if the patient has had too much sedation to allow for spontaneous awakening or breathing.



The use of non-physician, staff-driven protocols has been found to be very effective in assessing readiness to wean from the ventilator and has demonstrated a reduction in VAP.[52] 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.[53,54.]

Change Ideas

> Adopt SAT and SBT protocols with clearly defined roles and responsibilities (see Appendix V for sample SAT and SBT protocols).

> Incorporate into daily workflow:

- 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.

> Discuss the results of a patient's SAT and SBT during daily multidisciplinary rounds. The SAT and SBT results should also be included in nurse-to-nurse handoff, nurse-to-charge-nurse reports, and charge nurse-to-charge nurse reports.

Secondary Driver > "C" — CHOICE OF ANALGESIA AND SEDATION

Sedation typically assists in the pulmonary recovery of patients and should be goal-oriented. Too little sedation can lead to increased anxiety, increased work of breathing, reduced 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 oversedation, deliver the most effective sedative dose, and reduce the duration of mechanical-ventilation.[55,56] Type of sedation has emerged in the literature to be key in ventilator weaning, length of ventilation, ICU length of stay, and the development of delirium.[57,58,59] See Appendix VII for a Sedation Protocol for Mechanically Ventilated Patients.

The 2013 PAD Guidelines recommendations for agitation include:

> Titrate sedative medications to maintain a light level of sedation, unless clinically contraindicated.

> Use of non-benzodiazepine sedation strategies.

> Sedation management should be goal directed by using tools for agitation assessment such as the Richmond Agitation-Sedation Scale (RASS) and the Sedation-Agitation Scale (SAS).

> Analgesia-first sedation should be used in mechanically ventilated adult ICU patients.

Change Ideas

> Coordinate between nursing and respiratory therapy to manage the SAT and SBT.

> Discuss sedation goals and progress toward reduction in multidisciplinary rounds.

> Use whiteboards, the EMR, or other communication tools to enhance coordination.

> Consider strategies to decrease benzodiazepine usage, such as:

- Goal-directed sedation with titration of medications using sedation protocols and a sedation scale, i.e., RASS or SAS. See Appendix VII for a Sedation Protocol for Mechanically Ventilated Patients

> Consider the use of an alternative sedative to benzodiazepines (e.g., dexmedetomidine or propofol).

Secondary Driver > **"D"** — DELIRIUM MONITORING AND MANAGEMENT

Delirium, an acute form of brain dysfunction, remains undetected by both nurses and doctors in more than 65 percent of ICU patients.[60,61] Up to 81 percent of mechanically ventilated patients experience delirium.[62] Delirium is associated with a longer duration of mechanical ventilation, a longer length of stay in the ICU and the hospital and increased morbidity, mortality and long-term cognitive impairment.[63,64] The Food and Drug Administration (FDA) has not yet approved any drug to treat delirium, nor is there any evidence that the use of phenothiazines, such as haloperidol, treats delirium. Patients, however, should have their pain and agitation addressed while maintaining a balance to prevent the development of delirium.

2013 PAD Guidelines regarding delirium include:

> Delirium should be routinely monitored in all adult ICU patients.

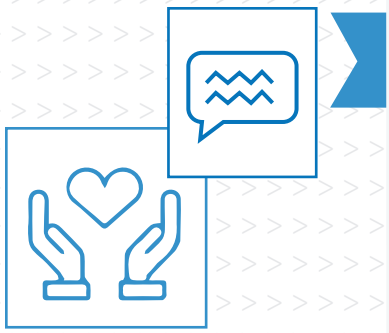
> Tools recommended for delirium assessment include the Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC).

> Promote early mobilization of adult ICU patients whenever feasible to reduce the incidence and duration of delirium.

> Use non-benzodiazepine sedation whenever possible.

> Benzodiazepines have been reported to be an independent risk factor for delirium.[65,66,67]

For more in-depth information on delirium monitoring and management, access the Iatrogenic Delirium Change Package at:
www.hret-hiin.org/topics/iatrogenic-delirium.shtml



Change Ideas

> Adopt a delirium prevention and management protocol.

> Assess the patient at least daily or as needed for confusion and delirium and to determine if the target RASS/SAS goal is met. If not, audit and analyze the reasons for missing the target. See Appendix VII for a Sedation Protocol for Mechanically Ventilated Patients.

> Designate a time of day for the SAT and SBT to be attempted that will not disrupt patient sleep cycles. See Appendix VI for a sample of Communication of Rest Period.

> Implement a pharmacist review of a patient's medication list to help identify any sedatives, analgesics, or anticholinergic drugs that may be discontinued or decreased in dose.

> Remove benzodiazepines from standard order sets.

> Avoid using benzodiazepines in patients at high risk for delirium.

Secondary Driver > **"E"** — EARLY PROGRESSIVE MOBILIZATION AND AMBULATION

Many research studies have sought to find the etiology of ICU-acquired weakness and for the acute onset of neuromuscular and functional impairment in the critically ill for which there is no plausible cause other than critical illness.[68,69,70] This weakness impairs ventilator weaning and functional mobility and can persist well after hospital discharge. Early progressive mobility can mitigate neuromuscular and 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.[71,72] The new PAD guidelines recommend early mobilization of adult ICU patients whenever feasible to reduce the incidence and duration of delirium.[73] Some studies suggest that early mobilization can decrease delirium duration by 50 percent, can decrease ICU length of stay by 25 percent, and can increase the likelihood of a return to independence by the time of discharge by nearly 75 percent.[74,75,76]

"Progressive mobility is defined as a series of planned movements in a sequential manner, beginning at a patient's current mobility status or level, with a goal of returning to his/her baseline."[77] See Appendix VIII for a Sample Mobility Protocol.

Change Ideas

> Modify standardized ICU admission orders to change the default activity level from bed rest to as tolerated.

> Establish a process for timely physical and occupational therapy evaluation for patients on ventilator support to establish a plan for progressive mobility.

> Include the mobility plan in interdisciplinary rounds, handoffs, and charge nurse reports.

> Partner nursing, rehabilitation, and respiratory into scheduling mobility activities.

Secondary Driver > "F" — FAMILY ENGAGEMENT AND EMPOWERMENT

The "F" in the bundle includes and highlights the family as an integral member of the care team instead of being a spectator on the sidelines. Families are important because they are a support to the emotional and mental health of the patient. They also support the clinical care team by asking questions that serve as reminders to include care interventions and can assist in care delivery, such as HOB elevation and ambulation, performing oral care and passive range of motion. It is up to the care team to enable families to feel comfortable speaking up, asking questions, and being an active part of the team. Invite families to participate in care by encouraging them to ask if other prevention efforts have been completed, such as oral care. Consumer groups have become valued allies in this effort by encouraging patients' families to partner with hospital staff to keep their loved ones safe.[78] The Vanderbilt ICU Delirium and Cognitive Impairment Study Group website provides family engagement and empowerment tools for families (see the bundles).

Change Ideas

> Educate patients and their families on the importance of keeping the HOB elevated, the risks of VAE, and other ways they can partner with caregivers to mitigate those risks. See Appendix IX for a Sample Family Education Tool.

> Ask family members to remind staff to elevate the HOB after linen changes, patient repositioning, or other regular events in the patient's day.

> Teach family volunteers how to perform oral care and how to suction oral secretions. Use teach-back and return demonstration to ensure adequate understanding and ability. Include family members or caregivers in monitoring and documenting oral care at the bedside.

> Teach families the importance of pain management and the behavioral manifestations of pain in the sedated patient utilizing the teach-back method. Include their pain assessments in bedside handoffs when family is present.

> Post the bundle elements at the bedside and teach family members, using teach-back.

> Include family in clinical rounds, physician rounds and bedside handoffs. Solicit feedback and observations from the patient's family on the patient's pain, sedation levels, oral care, HOB elevation, and mobility as much as possible.

> Encourage family members to keep an intensive care diary of events to share with their loved one to help the patient cope with traumatic events. Many patients experience post-traumatic stress disorder (PTSD) after their ICU stay.[79]

Suggested Process Measures for Your Test of Change

- Sample a small number of patients each month to determine if their levels of agitation and sedation are being assessed reliably (suggested sample size = 10 percent of the cases).
- Sample a small number of patients each month to determine if their levels of agitation and sedation assessed using SAS/RASS match the targets set forth by the ordering physicians (suggested sample size = 10 percent of the cases).
- Audit the percentage compliance of patients on progressive mobility protocol or meeting contraindications for non-compliance (e.g., hemodynamic instability).
- Audit the percentage of mechanically ventilated patients with documented family education regarding pneumonia prevention.

Hardwire the Process

Hardwiring the ABCDEF bundle can be challenging, but multidisciplinary collaboration is key. Team members' roles and tasks should be clearly defined. While education of clinicians is foundational, it is not a hardwiring tactic by itself. Hardwiring comes in the process design: adoption and testing of protocols; coordination of care among physicians, nursing and respiratory staff; and reminders for treatments and intervention. In addition, managing ABCDEF protocol implementation in smaller steps and anticipating staff fears about patient self-extubation are keys to implementing a sustainable process. Research literature suggests that self-extubation is slightly higher with SAT/SBT, but re-intubation rates are lower in the SBT/SAT group, indicating that many patients were ready for extubation.[80,81] Incorporate the ABCDEF bundle into standing orders as a default order, making its elements a daily part of care and provide opt-outs for patients for whom the bundle or its individual elements are contraindicated.

Choice of Tests and Interventions for VAE Risk Reduction:

There are many potentially effective interventions to reduce the risk of VAE. Improvement teams should begin their efforts by asking: "What is the greatest need at our facility? Where can we have the greatest impact?" Examples of approaches include:

> Begin with a bundle element that will be easy to trial, will likely be successful, and will have a significant positive impact. For example, implementing HOB elevation is less complicated than implementing SAT/SBT protocols yet greatly reduces VAE risk.

> Continue to implement the VAE bundle one element at a time.

IMPLEMENT SMALL TESTS OF CHANGE — Testing SAT/SBT protocols

PLAN

Do not reinvent the wheel. Use a protocol that has been successful at another hospital and adapt it at your facility. Test one step at a time. For example, do not plan to implement all of the ABCDEF recommendations at once. Concentrate first on the ABCD and then add the E and F.

DO

Ask a receptive, early-adopter physician on your improvement committee to trial these changes with one of his or her next 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, assisted by one nurse and one respiratory therapist.

STUDY

Debrief as soon as possible after the test with those involved, asking:

> What happened?

> What went well?

> What didn't go well?

> What do we need to revise for next time?

ACT

Do not wait for the next committee meeting to make changes. Revise and retest the revisions with the same physician, the same nurse and the same respiratory therapist.

Identify potential barriers

The complexity of the VAE prevention interventions require well designed and efficiently coordinated interdisciplinary processes. It is important that clinical leaders and executives be engaged in assessing for early warning signs of system failures that could be caused by new barriers or poorly designed systems. Investigating why those processes are breaking down will help identify barriers such as: engagement of front-line staff or physicians, flawed process design, little to no testing, availability of supplies, knowledge deficit or inadequate leadership.

Recognize that many physicians could perceive these interventions as a change in their practice and may be resistant to those changes, creating a barrier to adoption.

> Traditionally ventilation weaning and sedation were under a physician's sole purview, not duties implemented by a multidisciplinary, non-physician staff. To discuss the impact of these changes and promote acceptance and implementation, select respected lead physicians to serve on the improvement team and advocate as champions for these best practices with physician colleagues.

> Order sets and protocols are seen by some physicians as cookbook medicine. Reframe these interventions as evidence-based medicine, using research findings to suggest improved and individualized patient care options to reduce the risk of VAE. Allow physicians to "opt-out" if the bundle or one of its elements if contraindicated. Ask the physician to help improve the bundle by communicating and documenting the rationale for why the intervention was not appropriate for the patient.

Providers may define tasks as "ours" and "theirs." Examples include: oral care is "theirs" — a nursing task, medications are "ours" — the responsibility of the physician and ventilator management is "theirs" overseen 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, work-flows and peer education programs.[91,92]

These processes may be new territory for many physicians, nurses, respiratory therapists and pharmacists. Nurses and respiratory therapists, for example, may be concerned about errors and that patients may self-extubate during a SAT/SBT trial. They may also fear potential conflicts with or resistance from the medical staff. To mitigate these concerns:

> Educate all health care providers about the proven methodologies to reduce the risks and incidence of VAE.

> Share evidence and experience from comparable hospitals that demonstrate successful implementation of these processes without complications (e.g., self-extubations). If possible, visit a peer hospital that has successfully implemented the bundle to allow for peer sharing of learnings and experience.

> Test the supporting processes using rapid-cycle improvement methodologies involving front-line staff and physicians.

Enlist administrative leadership as sponsors to help remove or mitigate barriers

Because it is vital to have interdisciplinary collaboration to ensure success, enlist an executive sponsor who recognizes the value of teamwork and collaboration in preventing VAE. The sponsor can provide solutions and resources to address concerns about potential burdens of new process implementation such as ABCDEF bundles for hospital staff. An executive sponsor can help staff see the big picture on how these changes may benefit the entire organization, advocate for necessary funding, provide staffing and supplies, mitigate implementation barriers, and educate the governing board.

Change not only "The Practice," but also "The Culture"

Instituting the VAE bundle will require a change in culture, particularly among physicians. Physicians will be asked to transition from their traditional approach of individualizing mechanical ventilation management for each patient to a standardized and more effective approach. Physicians may be concerned about the perceived loss of control and the risks of shared responsibility. Physician champions can encourage their peers to actively monitor the effectiveness of therapy and the benefits to the patient and thereby promote increased acceptance of bundles.

Many pulmonologists and intensivists prefer to learn from peers rather than to follow impersonal expert advice. Use lead pulmonologists and intensivists as peer educators to advocate for the adoption of improvements such as order sets.

Nurses and respiratory therapists may be uncomfortable implementing staff-driven sedation or SAT/SBT protocols independent of physicians and may 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 new protocols and care delivery such as SAT/SBT protocols, oral care or HOB elevation.

PART 4: CONCLUSION AND ACTION PLANNING

VAE prevention is complex and requires a high rate of compliance to recommended bundle elements. It also requires a multidisciplinary approach that includes bedside nurses, respiratory therapists, intensivists, physical therapists, pharmacists and unit and facility leadership working together. Key to success is ongoing monitoring of compliance to bundles for data-driven decision-making, using data to drive practice and process changes and communication of supporting performance processes to staff.

Evaluate VAE prevention efforts by using the Top Ten Checklist (Appendix I). Ask "Do we have this element in place? If so, how well are we doing it? Is practice drift present?" Enlist physician, nursing, respiratory, and physical therapy champions to join the team and to assist in data analysis, determine potential interventions, and conduct small tests of change. If an element has not been adopted, consider adopting, testing and implementing the missing element.

Refine current processes to ensure ongoing high compliance by tapping into bedside staff. Ask "What gets in the way of performance (specific bundle element, i.e., SAT/SBT)? What change should be made to help? What is needed?" Test these solution ideas and adopt into process changes.

PART 5: APPENDICES

APPENDIX I: VENTILATOR-ASSOCIATED EVENTS (VAE) TOP TEN CHECKLIST

Associated Hospital/Organization: HRET HIIN

Purpose of Tool: A checklist to review current or initiate new VAE reduction interventions in your facility

Reference www.hret-hiin.org

2018 Ventilator-Associated Events (VAE) Top Ten Checklist

PROCESS CHANGE	IN PLACE	NOT DONE	WILL ADOPT	NOTES *(Responsible and By When?)*
1. Include all elements of the bundle in charge nurse rounds and nurse-to-charge-nurse reports.	☐	☐	☐	
2. Enlist a multidisciplinary approach. Nurses, physicians, and respiratory therapy staff need to work together to ensure bundle items, such as head of bed (HOB), spontaneous awakening trials (SAT), spontaneous breathing trials (SBT), and oral care are done according to recommendations.	☐	☐	☐	
3. Elevate HOB to between 30-45 degrees (use visual cues, designate one person to check for HOB every one to two hours).	☐	☐	☐	
4. Establish a process to perform routine oral care every two hours with antiseptic mouthwash every 12 hours (create visual cues, partner with respiratory therapy in performing oral care). Make the above oral care part of the ventilator order set as an automatic order that requires the physician to actively exclude it if contraindicated for a specific patient.	☐	☐	☐	
5. Intubate patients who have anticipated mechanical ventilation of greater than 72 hours with subglottic suction ETT.	☐	☐	☐	
6. Include venous thromboembolism (VTE) prophylaxis on ICU admission and ventilator order sets as an automatic order that would require the physician to actively exclude it.	☐	☐	☐	
7. Invite families to participate in care by encouraging them to ask if prevention efforts have been completed, such as oral care and HOB elevation. Educate families on the risk of VAE, preventive measures put in place and what they can do to help (e.g., perform oral care or passive range of motion exercises if willing).	☐	☐	☐	
8. Perform and coordinate SAT and SBT to maximize weaning opportunities when patient sedation is minimal. Coordinate between nursing and respiratory therapy to manage SAT and SBT, perform daily assessment or readiness to wean and extubate.	☐	☐	☐	
9. Establish a process for timely physical and occupational therapy evaluation for patients on ventilator support to establish a plan for progressive mobility.	☐	☐	☐	
10. Manage delirium by assessing patients for delirium at least once daily. Sedation should be goal oriented and should be administered, as ordered, by the physician according to a scale such as Richmond Agitation Sedation Scale (RASS).	☐	☐	☐	

APPENDIX II: EXAMPLE OF VAE PREVENTION VISUAL CUE – POSTED AT THE BEDSIDE

Associated Hospital/Organization: Developed by Cynosure Health Solutions, redesigned for the purposes of this change package

Purpose of Tool: Sign to post at bedside as a reminder to staff and family.

Reference: Cynosure Health Solutions

ICU BEST PRACTICE for VENTILATED PATIENTS

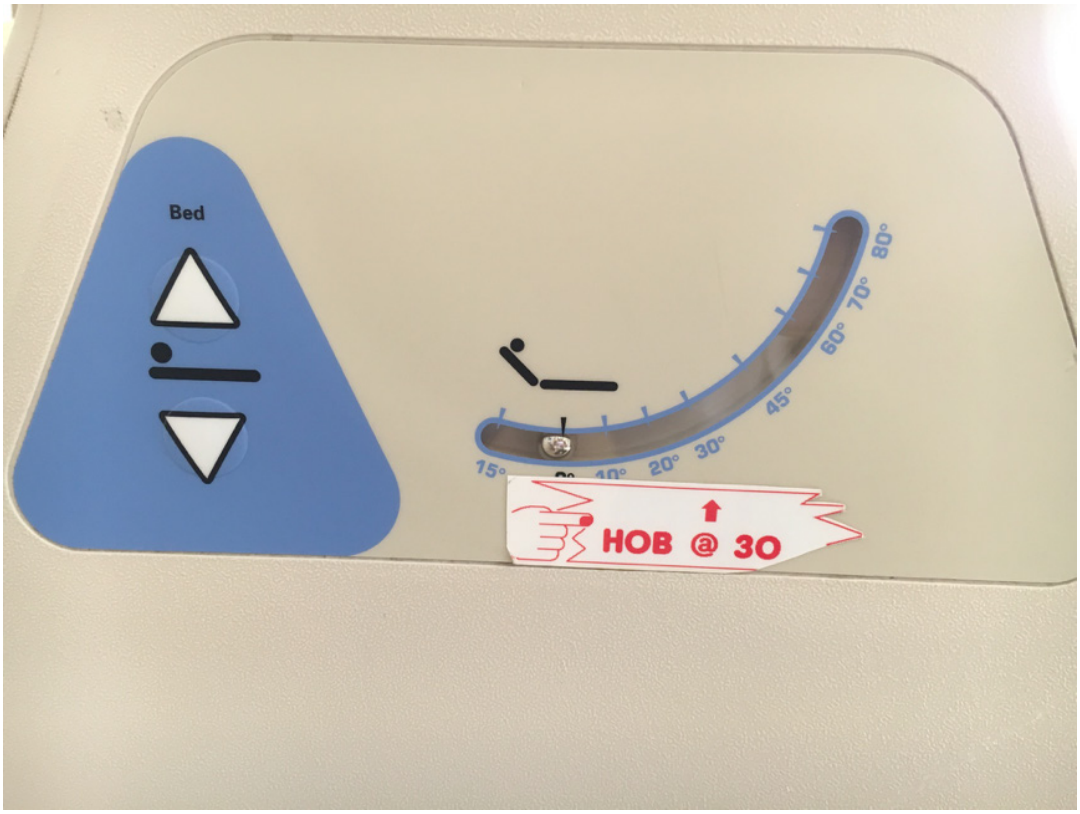
H	HEAD OF BED UP TO 30 — 45 DEGREES
E	ENTERAL FEEDING AND EVERY 2 HOURS ORAL CARE
A	AIR MATTRESS AND TURN EVERY TWO HOURS
D	DVT PROPHYLAXIS
S	SEDATION VACATION
U	ULCER PROPHYLAXIS
P	PAIN CONTROL

APPENDIX III: EXAMPLE OF A COLORED STRIPE ON BED FRAME SIDE RAIL

Associated Hospital/Organization: Cynosure Health Solutions

Purpose of Tool: Provide a visual cue on hospital beds to indicate HOB elevation of 30 degrees.

Reference: Cynosure Health Solutions



APPENDIX IV: EXAMPLE OF A BEST PRACTICE CHECKLIST

Associated Hospital/Organization: Cynosure Health Solutions, redesigned for the purposes of this change package

Purpose of Tool: Daily audit of intensive care unit best practices.

Reference: Cynosure Health Solutions

PBW and Tidal Volume for Females

HEIGHT	PBW	4 ML	5 ML	6 ML	7 ML	8 ML
4' 0" (48)	17.9	72	90	107	125	143
4' 1" (49)	20.2	81	101	121	141	162
4' 2" (50)	22.5	90	113	135	158	180
4' 3" (51)	24.8	99	124	149	174	198
4' 4" (52)	27.1	108	136	163	190	217
4' 5" (53)	29.4	118	147	176	206	235
4' 6" (54)	31.7	127	159	190	222	254
4' 7" (55)	34	136	170	204	238	272
4' 8" (56)	36.3	145	182	218	254	290
4' 9" (57)	38.6	154	193	232	270	309
4' 10" (58)	40.9	164	205	245	286	327
4' 11" (59)	43.2	173	216	259	302	346
5' 0" (60)	45.5	182	228	273	319	364
5' 1" (61)	47.8	191	239	287	335	382
5' 2" (62)	50.1	200	251	301	351	401
5' 3" (63)	52.4	210	262	314	367	419
5' 4" (64)	54.7	219	274	328	383	438
5' 5" (65)	57	228	285	342	399	456
5' 6" (66)	59.3	237	297	356	415	474
5' 7" (67)	61.6	246	308	370	431	493
5' 8" (68)	63.9	256	320	383	447	511
5' 9" (69)	66.2	265	331	397	463	530
5' 10" (70)	68.5	274	343	411	480	548
5' 11" (71)	70.8	283	354	425	496	566
6' 0" (72)	73.1	292	366	439	512	585
6' 1" (73)	75.4	302	377	452	528	603
6' 2" (74)	77.7	311	389	466	544	622
6' 3" (75)	80	320	400	480	560	640
6' 4" (76)	82.3	329	412	494	576	658
6' 5" (77)	84.6	338	423	508	592	677
6' 6" (78)	86.9	348	435	521	608	695
6' 7" (79)	89.2	357	446	535	624	714
6' 8" (80)	91.5	366	458	549	641	732
6' 9" (81)	93.8	375	469	563	657	750
6' 10" (82)	96.1	384	481	577	673	769
6' 11" (83)	98.4	394	492	590	689	787
7'0" (84)	100.7	403	504	604	705	806

PBW and Tidal Volume for Males

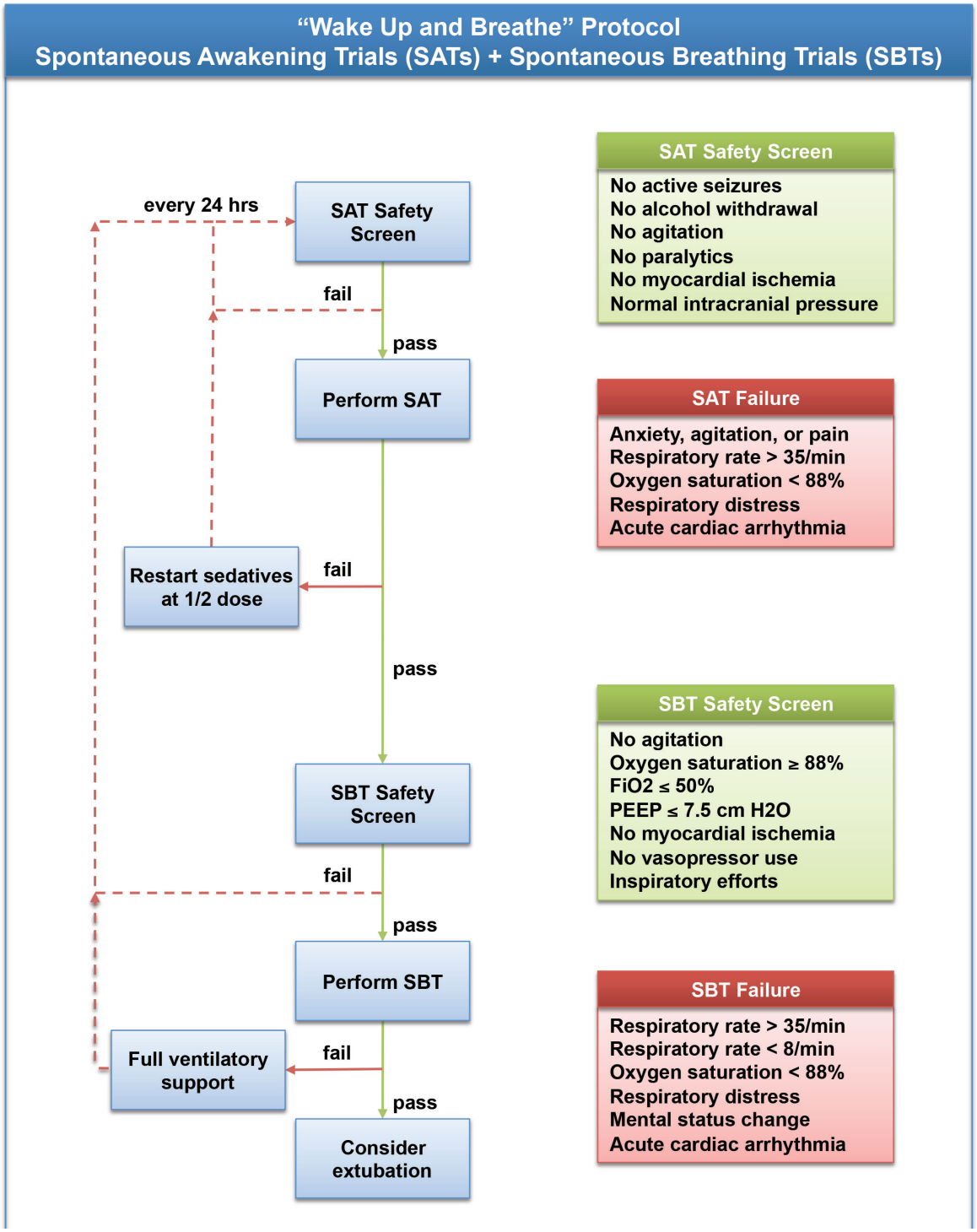
HEIGHT	PBW	4 ML	5 ML	6 ML	7 ML	8 ML
4'0" (48)	22.4	90	112	134	157	179
4'1" (49)	24.7	99	124	148	173	198
4'2" (50)	27	108	135	162	189	216
4'3" (51)	29.3	117	147	176	205	234
4'4" (52)	31.6	126	158	190	221	253
4'5" (53)	33.9	136	170	203	237	271
4'6" (54)	36.2	145	181	217	253	290
4'7" (55)	38.5	154	193	231	270	308
4'8" (56)	40.8	163	204	245	286	326
4'9" (57)	43.1	172	216	259	302	345
4'10" (58)	45.4	182	227	272	318	363
4'11" (59)	47.7	191	239	286	334	382
5'0" (60)	50	200	250	300	350	400
5'1" (61)	52.3	209	262	314	366	418
5'2" (62)	54.6	218	273	328	382	437
5'3" (63)	56.9	228	285	341	398	455
5'4" (64)	59.2	237	296	355	414	474
5'5" (65)	61.5	246	308	369	431	492
5'6" (66)	63.8	255	319	383	447	510
5'7" (67)	66.1	264	331	397	463	529
5'8" (68)	68.4	274	342	410	479	547
5'9" (69)	70.7	283	354	424	495	566
5'10" (70)	73	292	365	438	511	584
5'11" (71)	75.3	301	377	452	527	602
6'0" (72)	77.6	310	388	466	543	621
6'1" (73)	79.9	320	400	479	559	639
6'2" (74)	82.2	329	411	493	575	658
6'3" (75)	84.5	338	423	507	592	676
6'4" (76)	86.8	347	434	521	608	694
6'5" (77)	89.1	356	446	535	624	713
6'6" (78)	91.4	366	457	548	640	731
6'7" (79)	93.7	375	469	562	656	750
6'8" (80)	96	384	480	576	672	768
6'9" (81)	98.3	393	492	590	688	786
6'10" (82)	100.6	402	503	604	704	805
6'11" (83)	102.9	412	515	617	720	823
7'0" (84)	105.2	421	526	631	736	842

APPENDIX V: SAMPLE SAT/SBT PROTOCOL

Associated Hospital/Organization: Kansas University Hospital, Kansas City, KS

Purpose of Tool: Guide SAT/SBT daily assessment and intervention.

Reference: The "Wake Up and Breathe" protocol pioneered by Vanderbilt University can be found at: http://www.mc.vanderbilt.edu/icudelirium/docs/WakeUpAndBreathe.pdf



APPENDIX VI: SAMPLE COMMUNICATION OF REST PERIOD

Associated Hospital/Organization: Cynosure Health Solutions

Purpose of Tool: Communicate to team members and visitors that the patient is resting.

Reference: Cynosure Health Solutions

Shhh…I'm getting my ZZZZZZZZ

DO NOT DISTURB

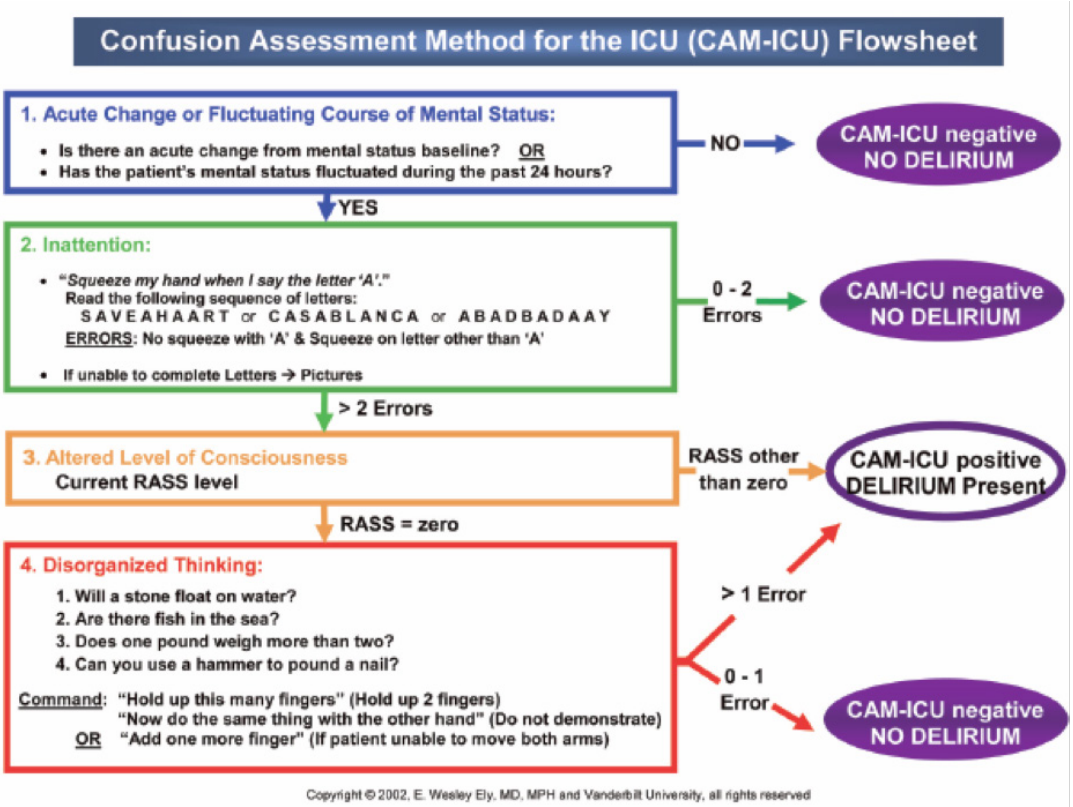
Sleep cycle in progress
Please check with nurse before entering

APPENDIX VII: SEDATION PROTOCOL FOR MECHANICALLY VENTILATED PATIENTS

Associated Hospital/Organization: ICU Delirium and the Cognitive Study Group

Purpose of Tool: Guide goal-directed analgesia and sedation.

Reference: www.icudelirium.org



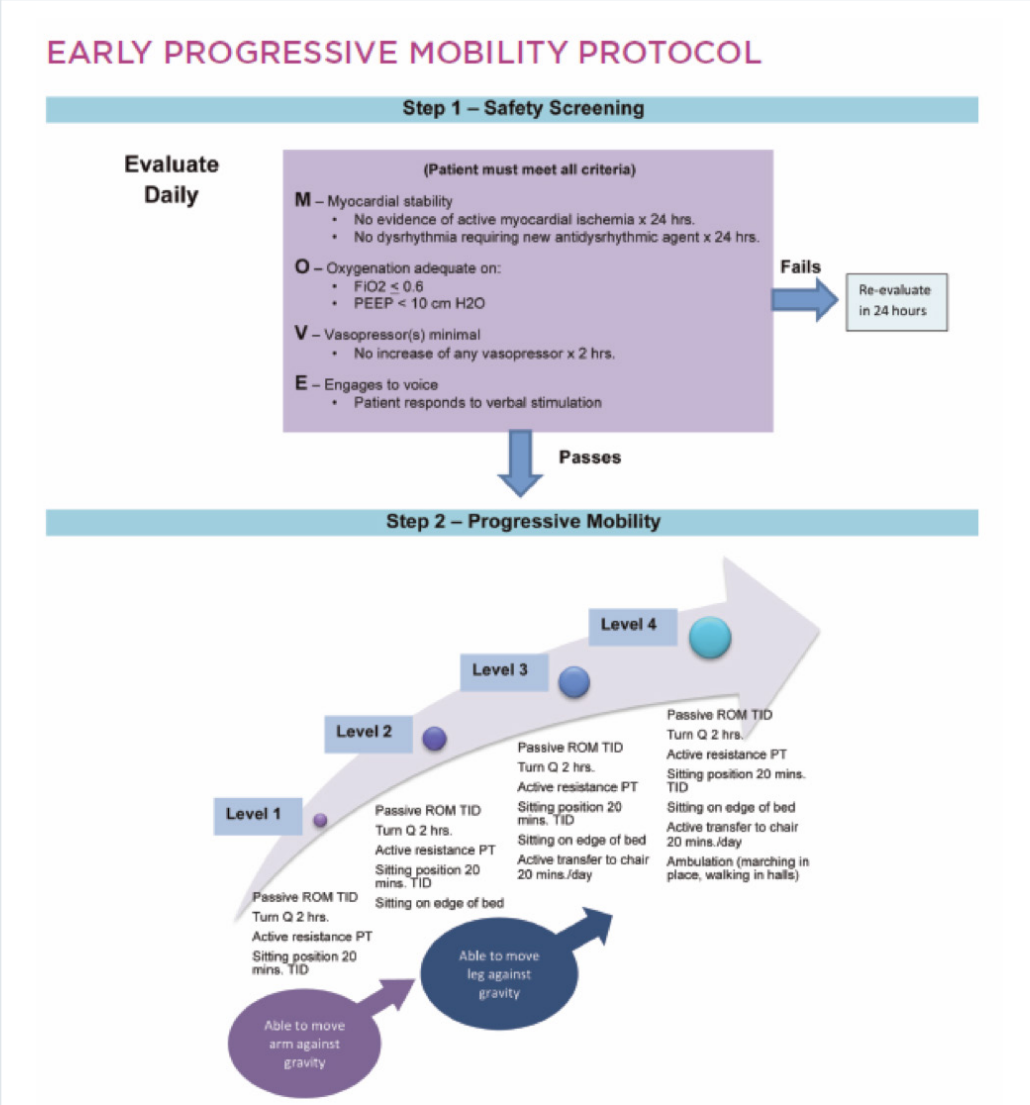
The Confusion Assessment Method in the ICU tool can be found at:
http://www.icudelirium.org/docs/CAM_ICU_flowsheet.pdf
Used with permission.

APPENDIX VIII: SAMPLE EARLY PROGRESSIVE MOBILITY PROTOCOL

Associated Hospital/Organization: American Association of Critical Care Nurses

Purpose of Tool: Reference guide for early progressive mobility.

Reference: www.AACN.org



American Association of Critical-Care Nurses. AACNPearl: Early Progressive Mobility Protocol. Available at: http://www.aacn.org/wd/practice/docs/tool%20kits/early-progressive-mobility-protocol.pdf. Accessed April 15, 2014. Used with permission.

APPENDIX IX: SAMPLE FAMILY EDUCATION TOOL

Associated Hospital/Organization: Cynosure Health Solutions, redesigned for the purposes of this change package

Purpose of Tool: Educate family members on mechanical ventilation and VAE prevention.

Reference: Cynosure Health Solutions

What does it all mean — my loved one is on a breathing machine?

The tube and machine:

Sometimes when a person is not able to breathe well on their own, a breathing tube is placed in the wind-pipe (trachea) and connected to a machine (ventilator) that helps the person breath. The ventilator provides air and oxygen when it supports the person's breathing. For patients on a ventilator, there is a risk for complications like pneumonia and blood clots.

The health care team's actions to reduce risk for complications:

The doctors, nurses, respiratory therapists, physical therapists and other members of the health care team work together to reduce the risk of complications of being on a ventilator. This work includes:

> Keeping the head of the bed up. This prevents secretions from causing pneumonia.

> Providing frequent oral care to help prevent pneumonia

> Using breathing tests to evaluate progress

> Administering medications to help the lungs breathe, called a "breathing treatment"

> Conducting simple exercises done in bed, called passive range of motion, to help keep muscles from getting too weak

What can you do to help your loved one?

As a family member, you can be a valuable member of the care team - an extra set of eyes or a gentle voice to help caregivers. Here are things you can do:

> Remind staff to raise the head of the bed if you see that it is flat. Be aware that sometimes the head of bed needs to be flat depending on patient's situation.

> Ask what you can do to help with bed exercises (passive range of motion) if you think you would be comfortable assisting the patient. Many loved ones like to help with the gentle exercises and stretching.

> Ask if you can help with the oral care, such as moistening lips and mouth.

> Ask other members of the health care team to wash their hands if you do not see them do this. Washing hands is the number one way to prevent infection!

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